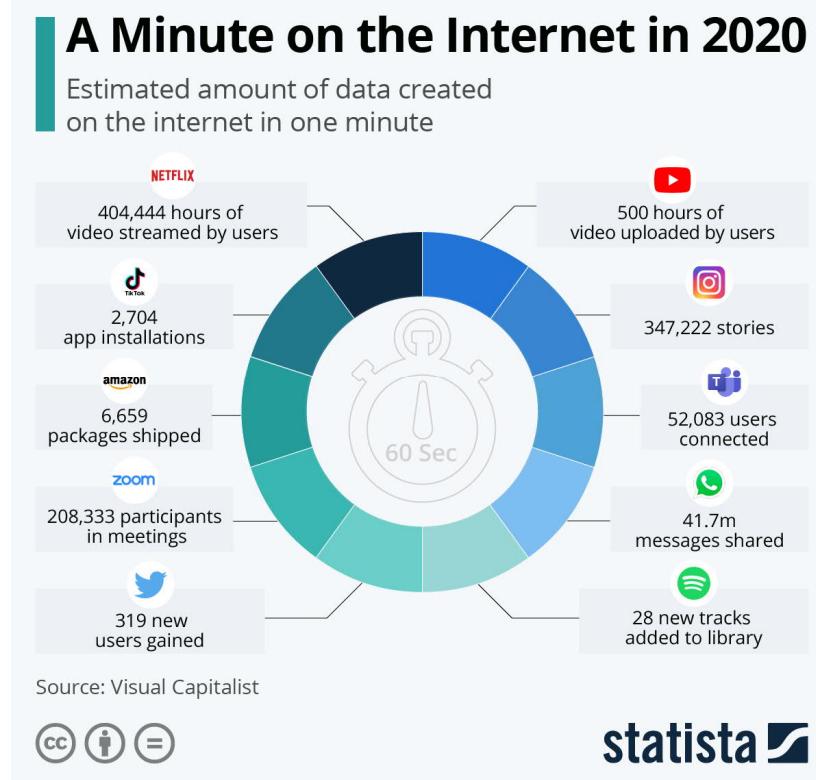


COMP.SE.100-EN ItSE  
Zoom begins soon...  
at 1415 o'clock.



- ### Gartner's Top Nine Strategic Technology Trends for 2021
1. Internet of Behaviors
  2. Total experience
  3. Privacy-enhancing computation
  4. Distributed cloud
  5. Anywhere operations
  6. Cybersecurity mesh
  7. Intelligent composable business
  8. AI engineering
  9. Hyperautomation

week	lectures	exam	weekly exercises	project assignment (exercise work)	week
35	L1: course basics		--- sign to WE groups ---	sign for project = grouping...	35
36	<a href="#">Project Assignment explained</a>		<b>WE1:</b> intro to requirements	grouping, groups to Moodle	36
37	L2: Sw Eng in general		<b>WE2:</b> Trello and agile way	group's Trello board ready with product backlog	37
38	L3: requirements		<b>WE3:</b> feasibility study and stakeholder analysis	working...	38
39	L4: basic UML diagrams		<b>WE4:</b> requirements	working...	39
40	L5: more UML diagrams	<b>EXAM-1</b>	<b>WES:</b> UML diagrams - Use case	working...	40
41	L6: different sw systems	<b>EXAM-1</b>	<b>WE6:</b> UML diagrams - concept/entity and navigation	deadline for 1st phase documentation and presentation	41
42	<b>examination week</b>		<b>examination week</b>	<b>examination week</b>	42
43	L7: life cycle models		<b>groups' 1st presentations</b>	<b>groups' 1st phase presentations</b>	43
44	L8: quality and testing		<b>WE7:</b> development processes	feedback group-to-group at PRP, from 1st phase	44
45	L9: project work	<b>Forms-2</b>	<b>WE8:</b> testing and error reporting	deadline for diagrams first versions (Moodle)	45
46	L10: project management		<b>WE9:</b> effort estimation	feedback to groups from diagrams (from assistants)	46
47	L11: open source, APIs, IPR		<b>WE10:</b> delivery contracts and terms of use	deadline for 2nd phase presentation (PRP)	47
48	L12: embedded systems, IoT		<b>groups' final presentations</b>	<b>groups' final presentations</b> / feedback g-to-g (PRP)	48
49	L13: recap, summary	<b>Forms-3</b>	---	final (2.) delivery of project documentation	49
50	<b>examination week</b>		<b>examination week</b>	feedback inside group, student-to-student at PRP	50
51	<b>examination week</b>		<b>examination week</b>	end of game / game over.	51
	<b>Lectures: Wed at 1415-16.</b>		<b>Weekly exercises:</b>		
			Mon 0815-10 discontinued	<b>AUTUMN 2020 (1-2. periods)</b>	
			<b>Mon 1215-14</b>	<b>are remote/distant learning.</b>	
			<b>Tue 0815-10</b>		
			<b>Tue 1415-16</b>		
			Wed 0815-10 discontinued .		

Remote/distant learning 2020.  
No contact teaching at ItSE 2020.



# COMP.SE.100 -EN

## ”ItSE”

# Introduction to Software Engineering

# 2020, 1-2. periods

5 credit units

# COMP.SE.100-EN (ItSE) Introduction to Software Engineering

Lecture 11, 18.11.2020

Tensu: remember to start Zoom lecture recording, at 1415

Prefer course Moodle over SISU information.

Students are recommended to follow Moodle News/messages.

## Course contents (plan)

1. Course basics, intro
2. Sw Eng in general, overview
3. Requirements
4. Different software systems
5. Basic UML Diagrams ("Class", Use Case, Navigation)
6. Life Cycle models
7. UML diagrams, in more detail
8. Quality and Testing
9. Project work
10. Project management
- 11. Open source, Big Data, IoT, APIs, IPR**
12. Embedded systems
13. Recap

## 11. Open source, APIs, IPR

- Open Source (OS), F(L)OSS
- Open Data
- Big Data ([FI: massadata](#))
- IoT (Internet of Things)
- API = application programming interface
- 
- IPR = intellectual property rights ([FI: tekijänoikeudet](#))
- licenses
- patents
- contracts (e.g. IT2018, non-competition, GDPR)
- reuse

## COMP.SE.100-EN, 2020, course schedule v6e (09.11.2020)

week	lectures	exam	weekly exercises	project assignment (exercise work)	week
35	L1: course basics		--- sign to WE groups ---	sign for project = grouping...	35
36	<a href="#">Project Assignment explained</a>		<a href="#">WE1: intro to requirements</a>	grouping, groups to Moodle	36
37	L2: Sw Eng in general		<a href="#">WE2: Trello and agile way</a>	group's Trello board ready with product backlog	37
38	L3: requirements		<a href="#">WE3: feasibility study and stakeholder analysis</a>	working...	38
39	L4: basic UML diagrams		<a href="#">WE4: requirements</a>	working...	39
40	L5: more UML diagrams	<a href="#">EXAM-1</a>	<a href="#">WE5: UML diagrams - Use case</a>	working...	40
41	L6: different sw systems	<a href="#">EXAM-1</a>	<a href="#">WE6: UML diagrams - concept/entity and navigation</a>	deadline for 1st phase documentation and presentation	41
42	<a href="#">examination week</a>		<a href="#">examination week</a>	<a href="#">examination week</a>	42
43	L7: life cycle models		<a href="#">groups' 1st presentations</a>	<a href="#">groups' 1st phase presentations</a>	43
44	L8: quality and testing		<a href="#">WE7: development processes</a>	feedback group-to-group at PRP, from 1st phase	44
45	L9: project work	<a href="#">Forms-2</a>	<a href="#">WE8: testing and error reporting</a>	deadline for diagrams first versions (Moodle)	45
46	L10: project management		<a href="#">WE9: effort estimation</a>	feedback to groups from diagrams (from assistants)	46
47	L11: open source, APIs, IPR		<a href="#">WE10: delivery contracts and terms of use</a>	deadline for 2nd phase presentation (PRP)	47
48	L12: embedded systems, IoT		<a href="#">groups' final presentations</a>	<a href="#">groups' final presentations / feedback g-to-g (PRP)</a>	48
49	L13: recap, summary	<a href="#">Forms-3</a>	---	final (2.) delivery of project documentation	49
50	<a href="#">examination week</a>		<a href="#">examination week</a>	feedback inside group, student-to-student at PRP	50
51	<a href="#">examination week</a>		<a href="#">examination week</a>	end of game / game over.	51
	<a href="#">Lectures: Wed at 1415-16.</a>		<a href="#">Weekly exercises:</a>		
			Mon 0815-10 discontinued	<a href="#">AUTUMN 2020 (1-2. periods)</a>	
			<a href="#">Mon 1215-14</a>	<a href="#">are remote/distant learning.</a>	
			<a href="#">Tue 0815-10</a>		
			<a href="#">Tue 1415-16</a>		
			Wed 0815-10 discontinued .		

## Current at course (w 47)

- WE10 were this week (risks and CPM), the last WE
  - continue updating your Trello (kanban) boards = use at your process
  - deadline for 2nd (final) presentations (week 47)
  - final (2nd) presentations at week 48
  - group to group feedback at PRP (week 49)
  - final delivery of req. documentation (week 49) Moodle
  - peer feedback inside group at PRP (week 50)
- 
- Third exam is changed to Forms, as covid is still here.
  - EXAM 3/3 w48-49 is changed to Forms-3 exam, to be on Wednesday, 02.12.2020 starting at 1615 o'clock.

## General course matters

Project assignment (exercise work)

Juanita: groups G01-G04

Aleksius: ODD groups; G05,G07,G09,G11,G13,G15,G17,G19,G21,G23,G27

Lauri: EVEN groups; G06,G08,G10,G12,G14,G16,G18,G20,G22,G24,G28

- Trello board is used as help for work division and assignment

### WE attendees:

- |               |                                |
|---------------|--------------------------------|
| • Mon 0815-10 | 9, 8,10, 5, 6, 4,              |
| • Mon 1215-14 | 11,12,12,13,11,12,10, 9, 9, 6. |
| • Tue 0815-10 | 3, 6, 4, 6, 5, 5,10,12,10,11.  |
| • Tue 1415-16 | 8,10, 9, 8, 5, 7,12,12,12,10.  |
| • Wed 0815-10 | 12,11, 9, 8, 7, 6,             |

Very small WEs are not reasonable, we discontinued two WE groups at 2nd study period.

# Course feedback seems to be open 18.11.-16.12.2020

Johdatus ohjelmistotuotantoon (in English), Luento-opetus 24.8.-2.12.2020 / OJP  
**Johdatus ohjelmistotuotantoon (in English), Luento-opetus 24.8.-2.12.2020** 24.8.2020 - 2.12.2020 [« Palaa toteutuksen tietoihin](#)

« [Loppupalautteet](#) [Välpalautteet](#) [Viestiloki](#)

[Näytä palautekysely ▾](#) [QR-koodi ▾](#) [Anna palautteen palautte](#)

**Palauteen tiedot**

Toteutusaika 24.8.2020 - 2.12.2020  
Palauteaika 18.11.2020 - 16.12.2020  
Keräystavat Opintojakso-palautejarjestelmä  
Antanut palautteen 2 kpl  
Kurssiosallistujia 109 kpl

**Vastausraportti**  
Graafit näytetään, kun palautteita on annettu vähintään kolme.

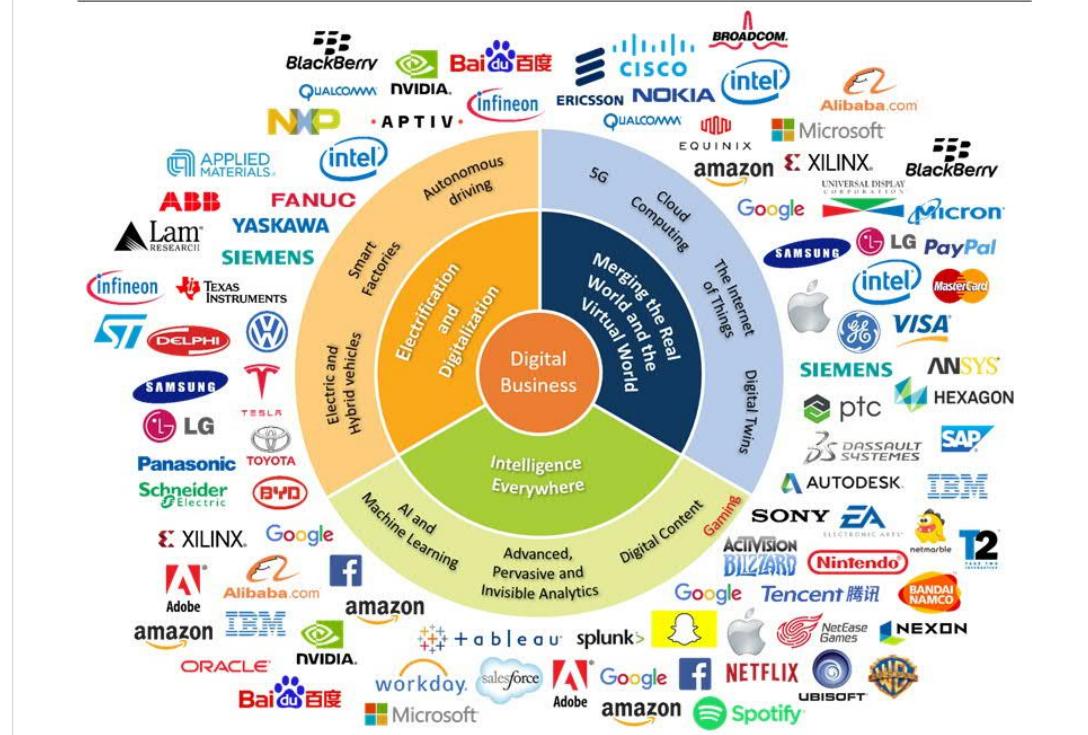
**Vapaat palautteet**  
Vapaat palautteet näytetään, kun palautteita on annettu vähintään kolme.

  
2%  
Antanut palautteen  
Palaute antamatta

[Muokkaa](#)

## TOP 10 STRATEGIC TECH TRENDS FOR 2018-2020

BLACKSWAN  
DEXTERITAS



TUNI \* COMP.SE.100-EN Introduction to Sw Eng

18.11.2020

13

[<https://www2.deloitte.com/us/en/insights/focus/tech-trends/2020/executive-summary.html>]

**Deloitte.**

Services ▾

Industries ▾

Insights ▾

Careers ▾

Search



US-EN ▾



**Deloitte.**  
Insights

By topic ▾

By sector ▾

Spotlight ▾

Article

### Tech Trends 2020

- Macro technology forces
- Ethical technology and trust
- Finance and the future of IT
- Digital twins: Bridging the physical and digital
- Human experience platforms
- Architecture awakens
- Horizon next: A future look at the trends

## Executive summary

### Tech Trends 2020



Scott Buchholz  
United States



Bill Briggs  
United States



TUNI \* COMP.SE.100-EN Introduction to Sw Eng

18.11.2020

14

5G

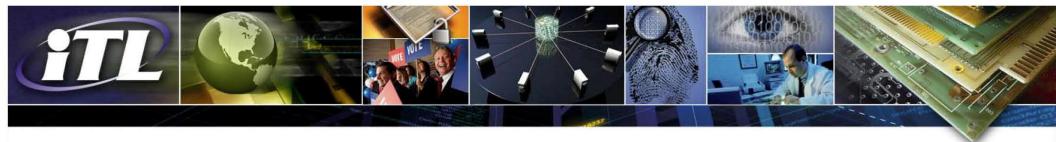
# IT infrastructure technology trends 2020

GlobalData Thematic Research | 11th February 2020 (Last Updated June 30th, 2020 11:58)

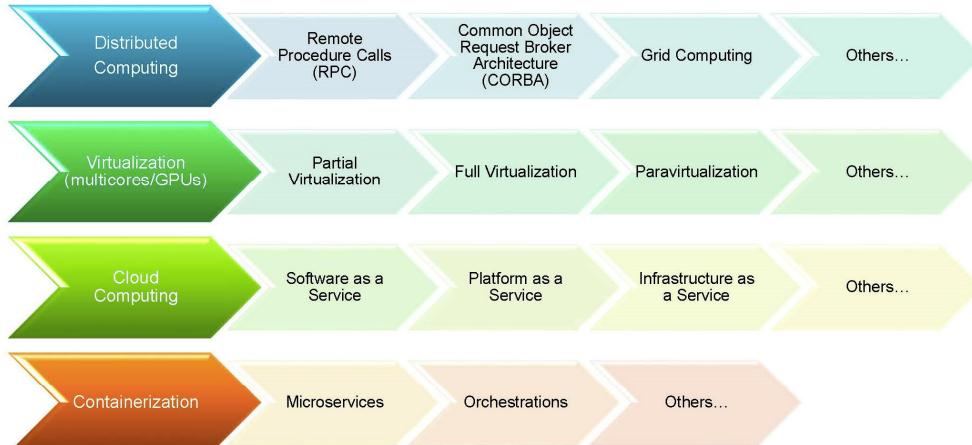


Listed below are the top IT infrastructure technology trends, as identified by GlobalData.

- Private cloud
- Edge computing
- High performance computing (HPC)
- AI
- Virtualisation.



## What's the Computing Infrastructure Trend?



# Open source (OS)

## Open source (OS) ("no price")

Open source, The Open Source Definition was originally derived from the [Debian Free Software Guidelines \(DFSG\)](#).

"The license of a Debian component **may not restrict any party from selling or giving away the software** as a component of an aggregate software distribution containing programs from several different sources. The license **may not require a royalty or other fee** for such sale."

"The program **must include source code**, and must allow distribution in source code as well as compiled form."

"The license **must allow modifications and derived works**, and must allow them to be distributed under the same terms as the license of the original software."

"The GPL, BSD, and Artistic licenses are examples of licenses that we consider free."

"Nearly all open source programs are in fact free."

Third party components = software functions, modules or components made by someone else, either free or commercial.

## Free software ("liberty")

Public domain = at last century, free software, either source code or just binary.

Free software is software that can be **freely used, modified, and redistributed** with only one restriction: **any redistributed version of the software must be distributed with the original terms of free use, modification, and distribution** (known as **copyleft**).

The definition of free software is stipulated as part of the GNU Project and by the Free Software Foundation. Free software may be packaged and distributed for a fee; the "free" refers to the ability to reuse it, modified or unmodified, as part of another software package. As part of the ability to modify, users of free software may also have access to and study the source code.

The concept of free software is the brainchild of Richard Stallman, head of the GNU Project. The best known example of free software is Linux.

"Free software" means software that respects users' freedom and community. Roughly, it means that the users have the freedom to run, copy, distribute, study, change and improve the software. Thus, "**free software**" is a matter of **liberty, not price**.

## Freeware (several definitions)

Freeware is any copyrighted software, application or program that may be freely downloaded, installed, used and shared. Such programs are available for use at no cost to general end users. **Freeware differs from free software, as the latter allows a user to modify source code for republishing or integration with other software.**

Freeware is computer software that is **made available free of charge, but which is copyrighted by its developer**, who retains the rights to control its distribution, modify it and sell it in the future. It is typically distributed without its source code, thus preventing modification by its users.

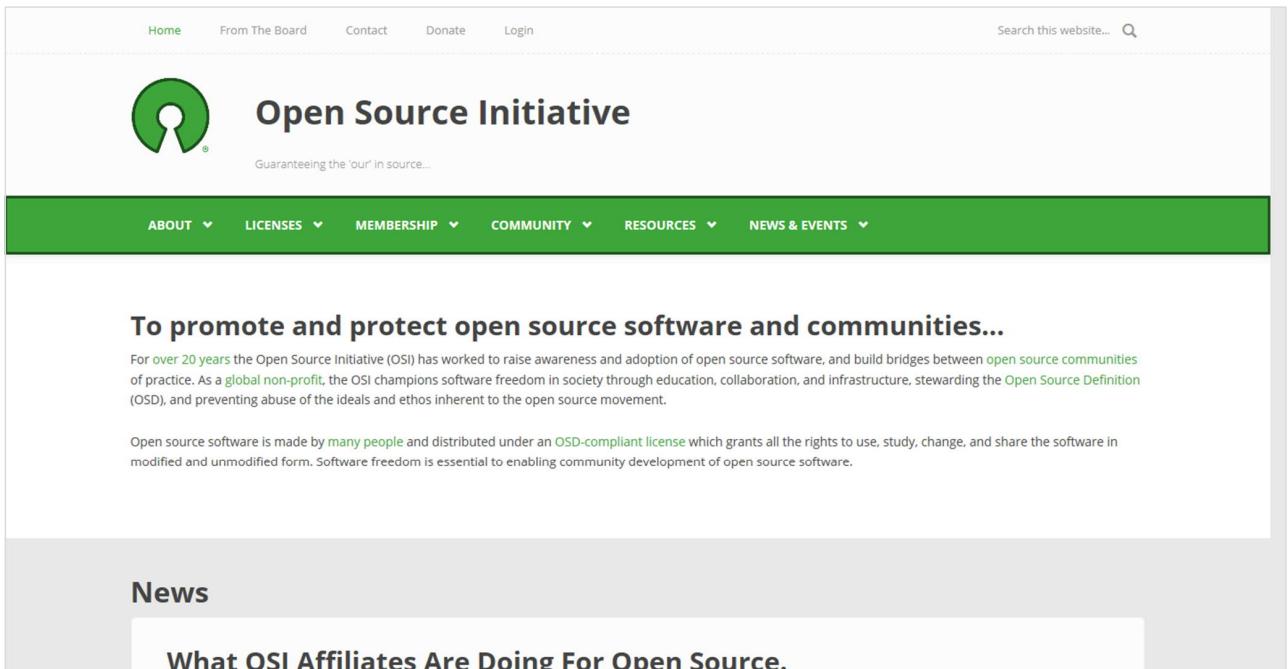
Freeware is software that is free to use. Unlike commercial software, it does not require any payment or licensing fee. It is similar to shareware, but will not eventually ask you for payment to continue using the software. You can legally download and use freeware for as long as you want without having to pay for it.

## shareware

Shareware (also known as trialware or demoware) — Trial software that you can use free of charge for a limited time (usually 30 or 60 days). After that, you're expected to pay to continue using it.



## www.opensource.org



The screenshot shows the homepage of the Open Source Initiative (OSI). The top navigation bar includes links for Home, From The Board, Contact, Donate, and Login, along with a search bar. A green header bar contains links for About, Licenses, Membership, Community, Resources, and News & Events. The main content area features a large heading 'Open Source Initiative' with a green keyhole logo to its left. Below the heading is the tagline 'Guaranteeing the "our" in source...'. A sub-section titled 'To promote and protect open source software and communities...' is described as having worked for over 20 years to raise awareness and build bridges between open source communities. It also mentions the OSD-compliant license and software freedom. A 'News' section highlights 'What OSI Affiliates Are Doing For Open Source.'

# The Open Source Definition

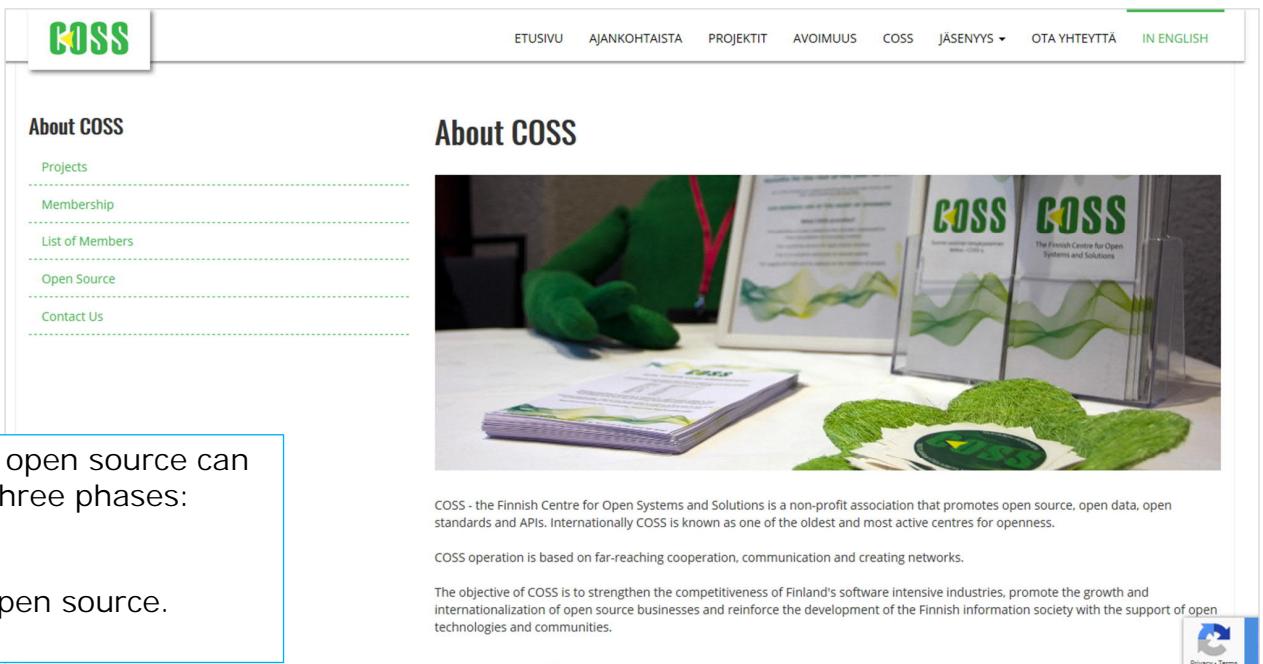
Open source doesn't just mean access to the source code.

The distribution terms of open-source software must comply with the following criteria:

1. Free Redistribution
2. Source Code
3. Derived Works
4. Integrity of The Author's Source Code
5. No Discrimination Against Persons or Groups
6. No Discrimination Against Fields of Endeavor
7. Distribution of License
8. License Must Not Be Specific to a Product
9. License Must Not Restrict Other Software
10. License Must Be Technology-Neutral.

[<https://opensource.org/osd>]

[www.cooss.fi](http://www.cooss.fi)



The evolution of open source can be divided into three phases:

- Free software
- Open source
- Commercial open source.

**About COSS**

Projects  
Membership  
List of Members  
Open Source  
Contact Us

**About COSS**

COSS - the Finnish Centre for Open Systems and Solutions is a non-profit association that promotes open source, open data, open standards and APIs. Internationally COSS is known as one of the oldest and most active centres for openness.

COSS operation is based on far-reaching cooperation, communication and creating networks.

The objective of COSS is to strengthen the competitiveness of Finland's software intensive industries, promote the growth and internationalization of open source businesses and reinforce the development of the Finnish information society with the support of open technologies and communities.

International partners

## About COSS

[Projects](#)[Membership](#)[List of Members](#)[Open Source](#)[Contact Us](#)

## Open Source

### The evolution of open source

An open source software is a software that has a licence granting the software's user several rights that traditional software licences do not. The idea of free access to a software's source code isn't new, as it has existed as long as there's been computer software. However, open source as a term has gotten more meanings and its relevance in business has changed.

The evolution of open source can be divided into three phases:

1. Free software
2. Open source
3. Commercial open source

During the first phase the idea of free software was created. It emphasises the 1985 founded Free Software Foundation's (FSF) ideal of freedom in software developing and usage. FSF aims to change software business so that it secures the basic freedoms FSF has defined. The GPL-licence, created by FSF, is essential tool for reaching this goal.

In the second phase the term open source was coined. In it the ethical principles of freedom were moved aside and companies, decentralized software developing process and open collaboration of software developers were brought to the spotlight. At this time, in 1998, the Open Source Initiative (OSI) was founded. It approved open source licences and maintained a list of them, getting the extensive support of software business. It also provided a base for growing community of developers.

In the third phase, commercial open source, it's typical to use open source as a part of traditionally licenced commercial products, services and trusted business models of this field. The objective of using open source is especially to lower the costs and increase the developing speed. Typical phenomena are the mixed source-products using both open and closed source technologies together and offering software as a service (this idea is also known by its acronym SaaS). The third phase began in 2005.



Open Source Initiative's definition states that open source software must comply with the following criteria:

1. Free Redistribution The license shall not restrict any party from selling or giving away the software as a component of an aggregate software distribution containing programs from several different sources. The license shall not require a royalty or other fee for such sale.
2. Source Code The program must include source code, and must allow distribution in source code as well as compiled form. Where some form of a product is not distributed with source code, there must be a well-publicized means of obtaining the source code for no more than a reasonable reproduction cost preferably, downloading via the Internet without charge. The source code must be the preferred form in which a programmer would modify the program. Deliberately obfuscated source code is not allowed. Intermediate forms such as the output of a preprocessor or translator are not allowed.
3. Derived Works The license must allow modifications and derived works, and must allow them to be distributed under the same terms as the license of the original software.
4. Integrity of The Author's Source Code The license may restrict source-code from being distributed in modified form only if the license allows the distribution of "patch files" with the source code for the purpose of modifying the program at build time. The license must explicitly permit distribution of software built from modified source code. The license may require derived works to carry a different name or version number from the original software.

5. No Discrimination Against Persons or Groups The license must not discriminate against any person or group of persons.
6. No Discrimination Against Fields of Endeavor The license must not restrict anyone from making use of the program in a specific field of endeavor. For example, it may not restrict the program from being used in a business, or from being used for genetic research.
7. Distribution of License The rights attached to the program must apply to all to whom the program is redistributed without the need for execution of an additional license by those parties.
8. License Must Not Be Specific to a Product The rights attached to the program must not depend on the program's being part of a particular software distribution. If the program is extracted from that distribution and used or distributed within the terms of the program's license, all parties to whom the program is redistributed should have the same rights as those that are granted in conjunction with the original software distribution.
9. License Must Not Restrict Other Software The license must not place restrictions on other software that is distributed along with the licensed software. For example, the license must not insist that all other programs distributed on the same medium must be open-source software.
10. License Must Be Technology-Neutral No provision of the license may be predicated on any individual technology or style of interface.

## FLOSS = FOSS

by Richard Stallman

The two political camps in the free software community are the free software movement and open source. The free software movement is a campaign for computer users' freedom; we say that a nonfree program is an injustice to its users. The open source camp declines to see the issue as a matter of justice to the users, and bases its arguments on practical benefits only.

To emphasize that "free software" refers to freedom and not to price, we sometimes write or say "free (*libre*) software," adding the French or Spanish word that means free in the sense of freedom. In some contexts, it works to use just "*libre* software."

A researcher studying practices and methods used by developers in the free software community decided that these questions were independent of the developers' political views, so he used the term "**FLOSS**," meaning "**Free/Libre and Open Source Software**", to explicitly avoid a preference between the two political camps. If you wish to be neutral, this is a good way to do it, since this makes the names of the two camps equally prominent.

Others use the term "**FOSS**," which stands for "**Free and Open Source Software**". This is meant to mean the same thing as "FLOSS," but it is less clear, since it fails to explain that "free" refers to freedom.

### 2.1.1 Essential criteria for Free and Open Source Software

Free and Open Source software licences must comply with four specific unrestricted criteria on the use to be made of the software, which have to be granted by the licensor to any licensee:

#### Freedom to run the program

Allow the licensee to run the program, for any purpose, therefore with no restrictions.

#### Freedom to study and change

Allow the licensee to study how the program works and modify it according to expectations or in order to answer the needs that the software is supposed to meet, with the precondition that access to the source code is given.

#### Freedom to redistribute

Allow the licensee to redistribute unmodified copies, without restrictions.

#### Freedom to distribute

Allow the licensee to distribute modified versions (known as derivative or larger works).

<https://docs.moodle.org/dev/>

moodle

DOCUMENTATION DOWNLOADS DEMO TRACKER DEVELOPMENT TRANSLATION MOODLENET Q

## Developer credits

### Contributions to Moodle

775 developers 57 countries 121388 commits

Display report for Moodle version All versions ▾

First name All A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Last name All A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Reset table preferences

1 2 3 4 5 6 7 8 »

First name / Last name	Country	Git commits	Git merges ▾
Eloy Lafuente (stronk7)	Spain	7912	7390

NAVIGATION

- Home
- Search
- Communities
- Developer credits
- Developers
- Contributions
  - 3.8.x
  - 3.7.x
  - 3.6.x
  - 3.5.x
  - 3.4.x
  - 3.3.x
  - 3.2.x
  - 3.1.x
  - 3.0.x

<https://opensource.guide/>

Open Source Guides are a collection of resources for individuals, communities, and companies who want to learn how to run and contribute to an open source project.

## Open Source Guides

Open source software is made by people just like you. Learn how to launch and grow your project.



### How to Contribute to Open Source

Want to contribute to open source? A guide to making open source contributions, for first-timers and for veterans.



### Starting an Open Source Project

Learn more about the world of open source and get ready to launch your own project.

WIRED

BUSINESS CULTURE GEAR IDEAS SCIENCE SECURITY TRANSPORTATION

SIGN IN

KLINT FINLEY BUSINESS 07.31.2019 07:00 AM

## When Open Source Software Comes With a Few Catches

Smaller open source developers are fighting back against tech giants like Amazon using their code in commercial services.

As open source software grows more popular, and important, developers face an existential question: [How to make money from something you give away for free?](#) Companies that release software under open source licenses generate revenue in different ways. Some [sell support](#), including Red Hat, which IBM acquired for \$34 billion earlier this month. Others, like cloud automation company HashiCorp, [sell proprietary software based on the open source components](#). But with the rise of cloud computing, developers see their open source code being bundled into services and sold by other companies. Amazon, for example, sells a cloud-hosted service based on the popular open source database Redis, which competes with a similar cloud-hosted service offered by Redis Labs, the sponsor of the open source project. To protect against such scenarios, companies behind popular open source projects are restricting how others can use their software. Redis Labs started the trend last year when it relicensed several add-ons for its core product under terms that essentially prohibit offering those add-ons as part of a commercial cloud computing service. That way, Amazon and other cloud providers can't use those add-ons in their competing Redis services. Companies that want the functionality provided by those add-ons need to develop those features themselves, or get permission from Redis Labs.

# OS / OSS = avoin lähdekoodi

- OS = open source
- OSS = open source software

There is not just one definition for "open source".

<https://coss.fi/avoimuus/>

<https://opensource.org/docs/osd>

<http://www.gnu.org/philosophy/free-sw.html>

## Source Code Library

Would you  
dare to use  
such ?

### Share your code

Help us improve the library

upload your code

```
currentSize :>
    & const
    & currentSize :>
        & operator<int>( int index )
        & index < 0 || index >= currentSize :>
            & throw ArrayIndexOutOfBoundsException( )
        & return objects< int >( index )
        & object & operator<int>( int index ) const
        & index < 0 || index >= currentSize :>
            & throw ArrayIndexOutOfBoundsException( )
        & ...
```

DOWNLOAD CODE

[[www.embedded.com](http://www.embedded.com)]

# Open data

[<https://opendatahandbook.org/guide/en/what-is-open-data/>]

Open data is data that can be freely used, re-used and redistributed by anyone - subject only, at most, to the requirement to attribute and sharealike.

The full Open Definition gives precise details as to what this means. To summarize the most important:

- Availability and Access: the data must be available as a whole and at no more than a reasonable reproduction cost, preferably by downloading over the internet. The data must also be available in a convenient and modifiable form.
- Re-use and Redistribution: the data must be provided under terms that permit re-use and redistribution including the intermixing with other datasets.
- Universal Participation: everyone must be able to use, re-use and redistribute - there should be no discrimination against fields of endeavour or against persons or groups. For example, 'non-commercial' restrictions that would prevent 'commercial' use, or restrictions of use for certain purposes (e.g. only in education), are not allowed.

If you're wondering why it is so important to be clear about what open means and why this definition is used, there's a simple answer: interoperability.

# Open data

Open data is information or content made freely available to use and redistribute, subject only to the requirement to attribute it to the source.

The term also may be used more casually to describe any data that is shared outside the organization and beyond its original intended use, for example, with business partners, customers or industry associations.

Formally, data designated as "open" is subject to several conditions and licensing that can be found at [opendefinition.org](https://opendefinition.org).

[<https://www.gartner.com/en/information-technology/glossary/open-data>]

## opendefinition.org

[Open Definition](#)[The Definition](#)[Conformant Licenses](#)[Participate](#)[News](#)

### The Open Definition

The [Open Definition](#) sets out principles that define "openness" in relation to data and content.

It makes **precise** the meaning of "open" in the terms "**open data**" and "**open content**" and thereby ensures **quality** and encourages **compatibility** between different pools of open material.

It can be summed up in the statement that:

**"Open means anyone can freely access, use, modify, and share for any purpose (subject, at most, to requirements that preserve provenance and openness)."**

Put most succinctly:

**"Open data and content can be freely used, modified, and shared by anyone for any purpose"**

[Read the full Open Definition »](#)

#### THE OPEN DEFINITION IN YOUR LANGUAGE

አማርኛ | Belarusian | Bulgarian | Català | Czech | Dansk | Deutsch | Eesti | Ελληνικά | English | Español | Euskara | Suomi | Français | Galego | עברית | हिन्दी | Croatian | Magyar | Bahasa Indonesia | Іслінка | Italiano | 日本語 | 한국어 | ລາວພາສາລາວ | ພັນຍາ | Norsk (bokmål) | Polszczyzna | Português Brasileiro | Português | Русский | Shqip | Српски | Svenska | Θαύμα | Türkçe | Українська | 简体中文 | 繁體中文

<http://opendefinition.org/>

The Open Definition states: "A piece of content or data is open if anyone is free to use, reuse, and redistribute it — subject only, at most, to the requirement to attribute and share-alike."

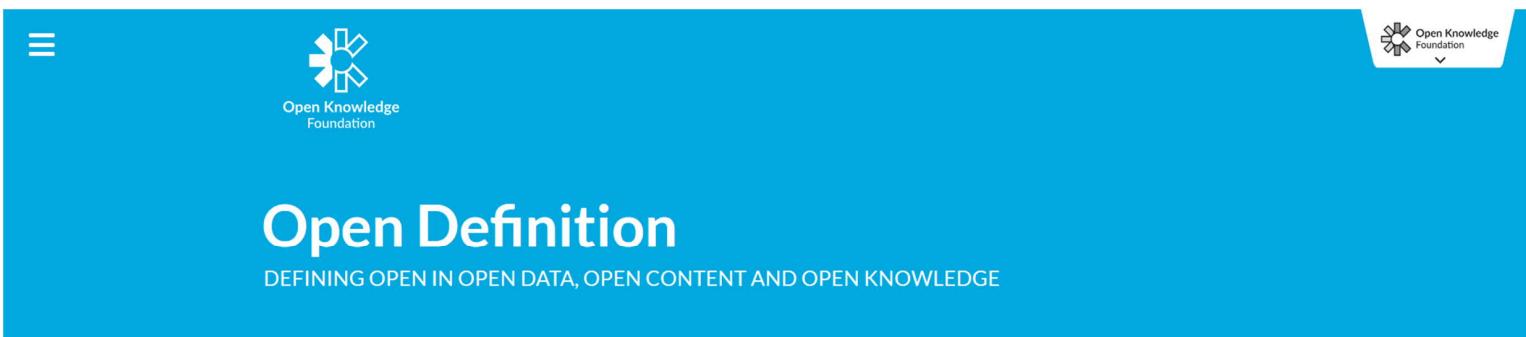
"Open means anyone can freely access, use, modify, and share for any purpose (subject, at most, to requirements that preserve provenance and openness)."

Put most succinctly:

"Open data and content can be freely used, modified, and shared by anyone for any purpose"

Summary: Knowledge is open if anyone is free to access, use, modify, and share it — subject, at most, to measures that preserve provenance and openness.

<http://opendefinition.org/>



The screenshot shows the homepage of the Open Definition website. At the top, there is a navigation bar with a menu icon, the Open Knowledge Foundation logo, and a search bar. The main title "Open Definition" is prominently displayed in large white letters, with the subtitle "DEFINING OPEN IN OPEN DATA, OPEN CONTENT AND OPEN KNOWLEDGE" below it. The background is blue.

## Open Definition 2.1

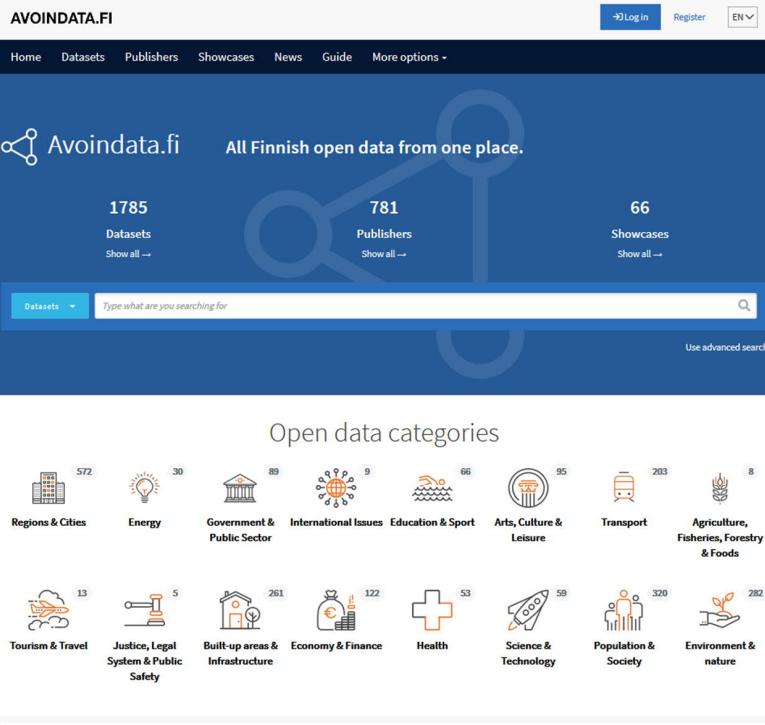
Version 2.1

The Open Definition makes precise the meaning of "open" with respect to knowledge, promoting a robust commons in which anyone may participate, and interoperability is maximized.

**Summary:** Knowledge is open if anyone is free to access, use, modify, and share it — subject, at most, to measures that preserve provenance and openness.

This essential meaning matches that of "open" with respect to software as in the [Open Source Definition](#) and is synonymous with "free" or "libre" as in the [Free Software Definition](#) and [Definition of Free Cultural Works](#).

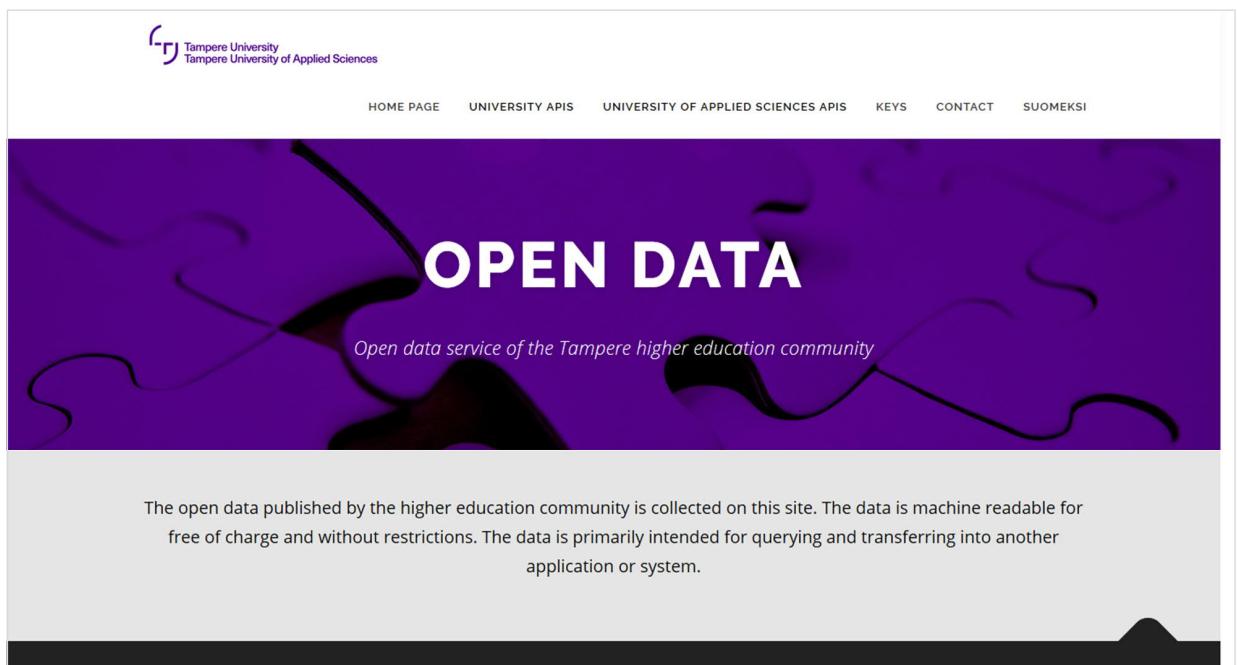
[<https://www.avoindata.fi/en>]



The screenshot shows the Avoindata.fi homepage. At the top, there's a navigation bar with links for Home, Datasets, Publishers, Showcases, News, Guide, and More options. On the right, there are buttons for Login, Register, and language selection (EN). The main header features the Avoindata.fi logo and the tagline "All Finnish open data from one place." Below this, there are three sections showing statistics: 1785 Datasets, 781 Publishers, and 66 Showcases. A large search bar with a magnifying glass icon is centered, with a dropdown menu showing "Datasets". Below the search bar is a link to "Use advanced search". The bottom section displays a grid of 16 open data categories, each with an icon and a count of datasets:

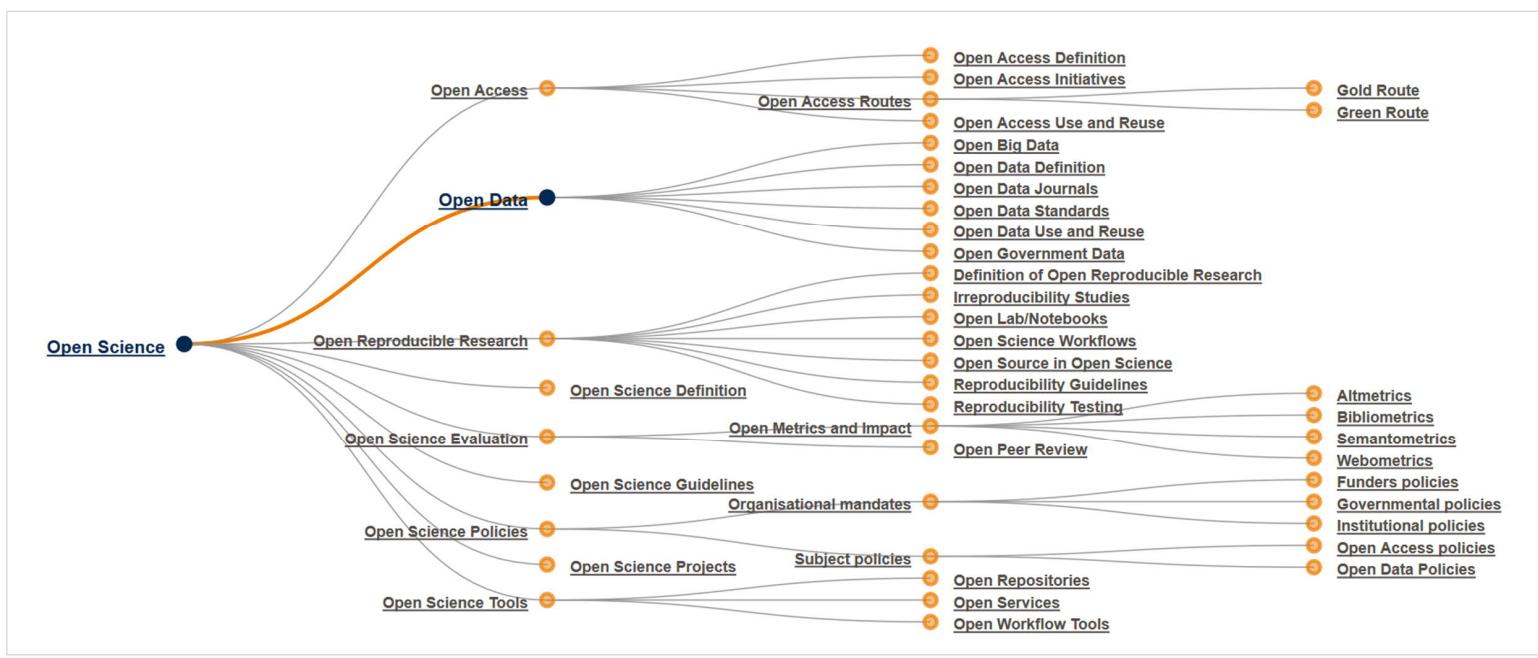
Open data categories	
 572	 30
 89	 9
 66	 95
 203	 8
 13	 5
 261	 122
 53	 59
 320	 282

[opendata.tuni.fi](http://opendata.tuni.fi)

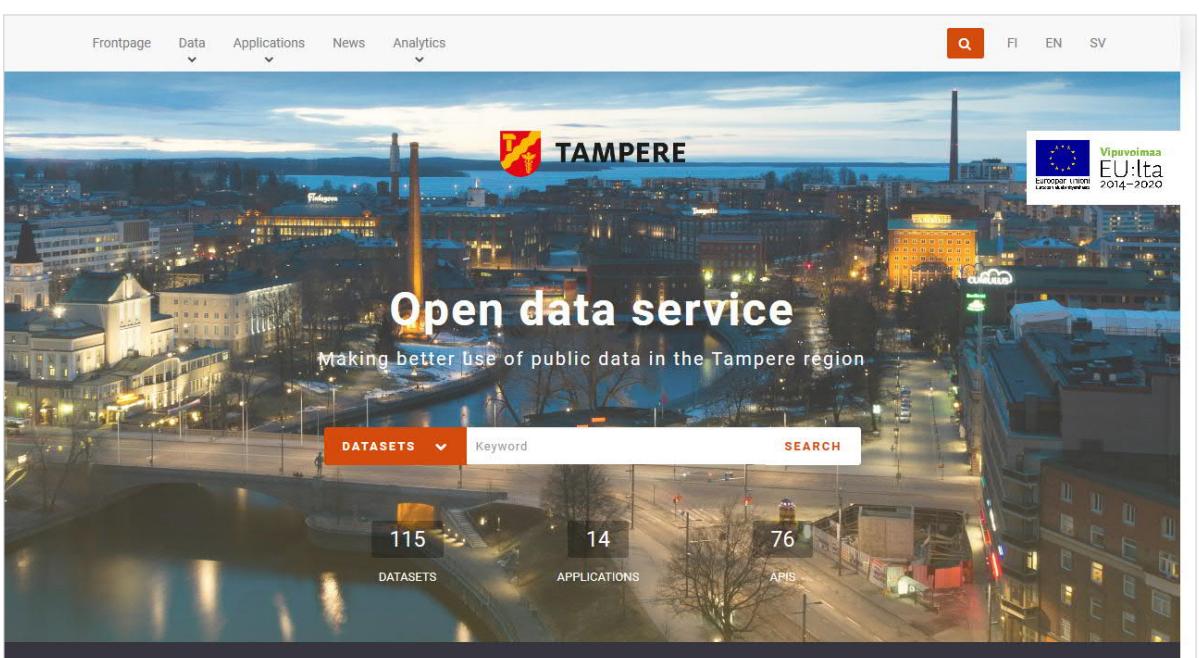


The screenshot shows the opendata.tuni.fi homepage. At the top, there's a navigation bar with links for HOME PAGE, UNIVERSITY APIS, UNIVERSITY OF APPLIED SCIENCES APIS, KEYS, CONTACT, and SUOMEKSI. The main visual is a large, abstract purple graphic with black wavy lines. Overlaid on this graphic is the word "OPEN DATA" in large white capital letters. Below this, a smaller text reads "Open data service of the Tampere higher education community". The bottom section contains a paragraph of text:

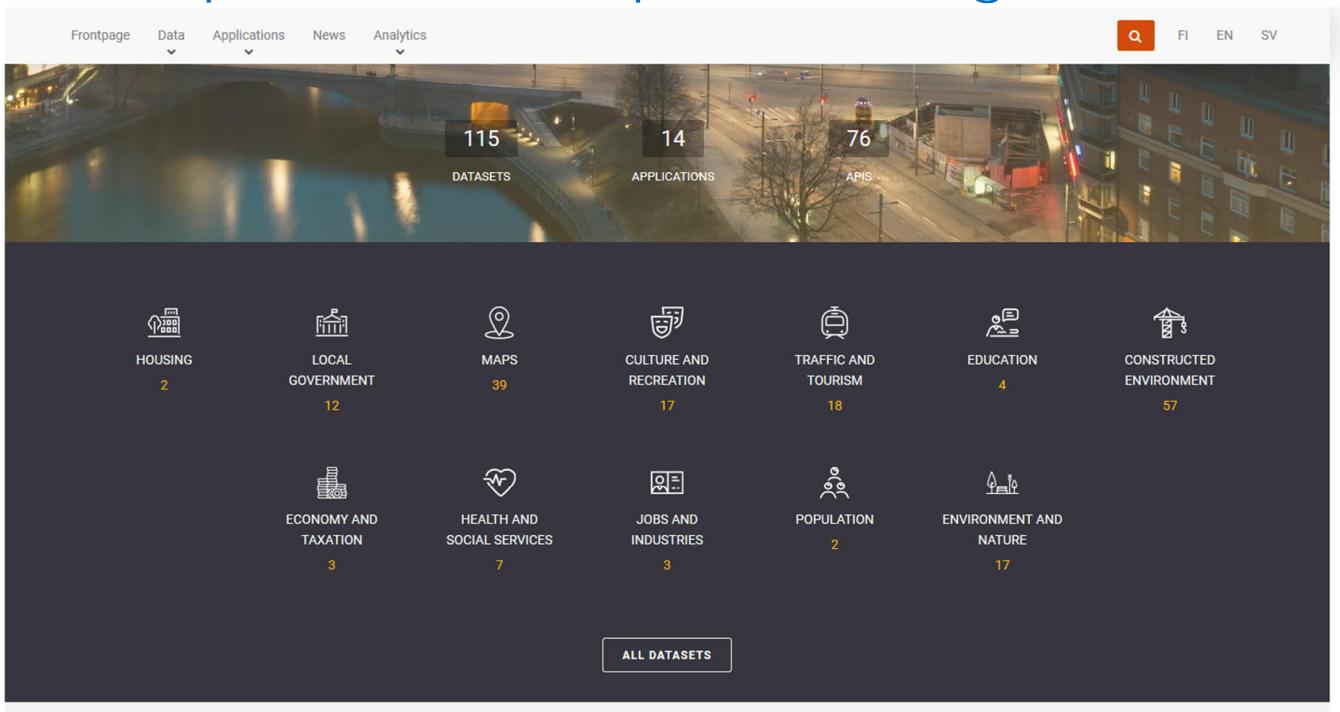
The open data published by the higher education community is collected on this site. The data is machine readable for free of charge and without restrictions. The data is primarily intended for querying and transferring into another application or system.



[data.tampere.fi/en\\_gb/](http://data.tampere.fi/en_gb/)



[https://data.tampere.fi/en\\_gb/](https://data.tampere.fi/en_gb/)



The screenshot shows the Tampere Data Platform homepage. At the top, there is a navigation bar with links to Frontpage, Data (with dropdown), Applications (with dropdown), News (with dropdown), Analytics (with dropdown), a search icon, and language links for FI, EN, and SV. Below the navigation is a banner featuring three images: a bridge over a river at night with a 'DATASETS' overlay showing '115', a street scene with a bus and a 'APPLICATIONS' overlay showing '14', and a city street at night with a 'APIs' overlay showing '76'. Below the banner is a grid of 14 categories, each with an icon and a count. An 'ALL DATASETS' button is located at the bottom right of the grid.

Category	Count
HOUSING	2
LOCAL GOVERNMENT	12
MAPS	39
CULTURE AND RECREATION	17
TRAFFIC AND TOURISM	18
EDUCATION	4
CONSTRUCTED ENVIRONMENT	57
ECONOMY AND TAXATION	3
HEALTH AND SOCIAL SERVICES	7
JOBs AND INDUSTRIES	3
POPULATION	2
ENVIRONMENT AND NATURE	17

## 4 Steps to Open Data

1. Choose a Data Set
2. Attach an Open License
3. Format the Data to Your Audience
4. Make it Discoverable.

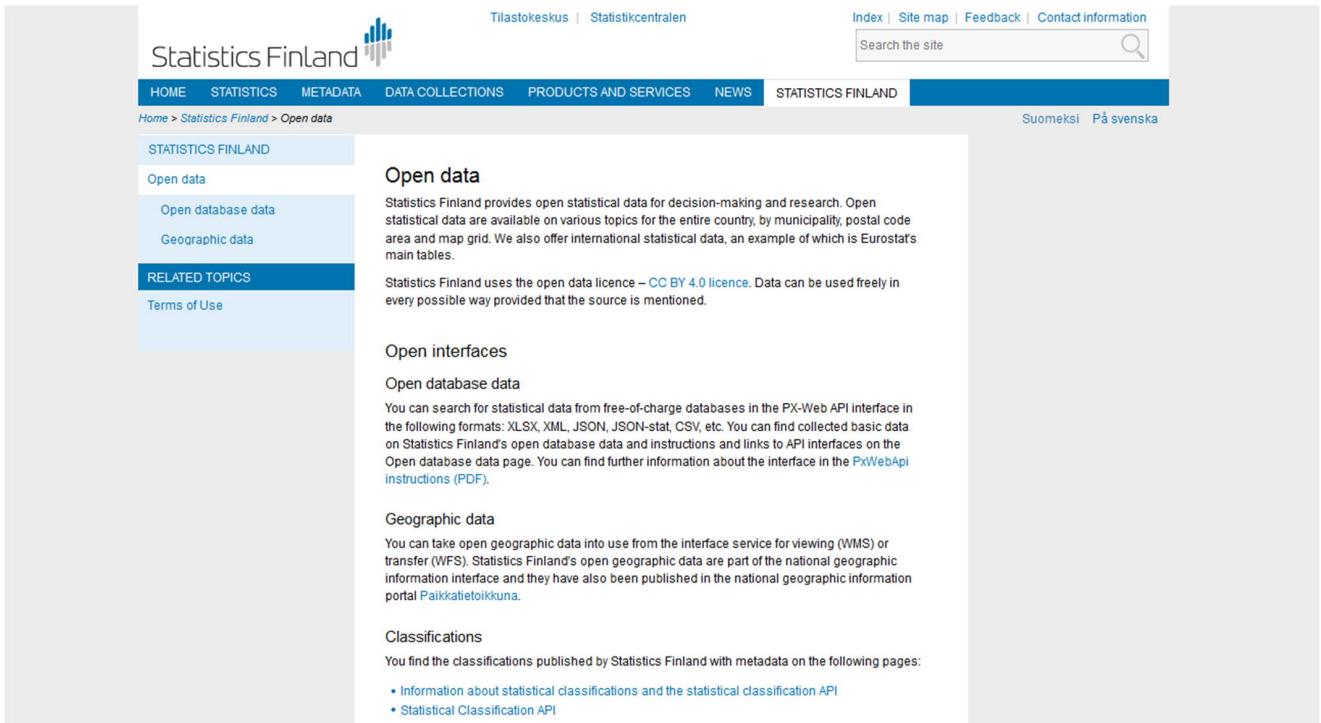
[<https://www.govtech.com/data/Got-Data-Make-it-Open-Data-with-These-Tips.html>]

## Open Data Defined

The term “Open Data” has a very precise meaning. Data or content is open if anyone is free to use, re-use or redistribute it, subject at most to measures that preserve provenance and openness.

There are two dimensions of data openness:

1. The data must be legally open, which means they must be placed in the public domain or under liberal terms of use with minimal restrictions.
2. The data must be technically open, which means they must be published in electronic formats that are machine readable and non-proprietary, so that anyone can access and use the data using common, freely available software tools. Data must also be publicly available and accessible on a public server, without password or firewall restrictions. To make Open Data easier to find, most organizations create and manage Open Data catalogs.



The screenshot shows the Statistics Finland website with a focus on their open data offerings. The top navigation bar includes links for Home, Statistics, Metadata, Data Collections, Products and Services, News, and Statistics Finland. The main content area features a sidebar with links for Statistics Finland, Open data (selected), Open database data, and Geographic data. The main content area discusses open data, mentioning the CC BY 4.0 license and providing links for open interfaces, database data, geographic data, and classifications. The footer includes links for Index, Site map, Feedback, Contact information, and search functionality.

[www.stat.fi/org/avoindata/index\\_en.html](http://www.stat.fi/org/avoindata/index_en.html)



The Week in Data | Membership | Jobs

Knowledge & opinion | Projects & services | Events | Global network directory | About the ODI | Search the ODI | More

Our strategy | Tender opportunities | ODI Team | Contact us | Terms of use, privacy and policies | Jobs | Brand

## About the ODI

 Share

**The ODI was co-founded in 2012 by the inventor of the web Sir Tim Berners-Lee and artificial intelligence expert Sir Nigel Shadbolt to advocate for the innovative use of open data to affect positive change across the globe.**

*The ODI was co-founded in 2012 by the inventor of the web Sir Tim Berners-Lee and artificial intelligence expert Sir Nigel Shadbolt to show the value of open data, and to advocate for the innovative use of open data to affect positive change across the globe.*

We're an independent, non-profit, non-partisan company that, since our creation, has welcomed high-profile board members including Mumsnet founder Justine Roberts, Lastminute.com founder Baroness Martha Lane Fox and former European Commissioner Neelie Kroes.

Headquartered in London, with an international reach, hundreds of members, thousands of people trained, dozens of startups incubated, and a convening space in the heart of the capital, we invite everyone interested in developing with data – whether on an individual, organisational or global level – to get in touch.



EUROPEAN DATA PORTAL

English (en) Site content 

Data ▾ Impact & Studies ▾ Training ▾ News & Events ▾ About ▾

### Search Datasets

By category By term

 Agriculture, Fisheries, Forestry & Foods	 Economy & Finance	 Education, Culture & Sport	 Energy	 Environment
 Government & Public Sector	 Health	 International Issues	 Justice, Legal System & Public Safety	 Population & Society
 Regions & Cities	 Science & Technology	 Transport		

**European Data Portal**

The European Data Portal harvests the metadata of Public Sector Information available on public data portals across European countries. Information regarding the provision of data and the benefits of re-using data is also included.

**36 Countries** **81 Catalogues** **1179220 Datasets**

# Big data

## Big data (FI: massadata)

If you think whether it is big data or not, it is.

big data [ITU-T Y.3600]: A paradigm for **enabling the collection, storage, management, analysis and visualization**, potentially under real-time constraints, **of extensive datasets** with heterogeneous characteristics.

NOTE – Examples of datasets characteristics include high-volume, high-velocity, high-variety, etc.

Big data: very large sets of data that are produced by people using the internet, and that can **only** be stored, understood, and **used with the help of special tools** and methods:

Supermarkets make use of big data to track user behaviour and target consumers with things they like.

[<https://dictionary.cambridge.org/dictionary/english/big-data>]

## Big data, another explanation

Big data is a combination of structured, semistructured and unstructured data collected by organizations that can be mined for information and used in machine learning projects, predictive modeling and other advanced analytics applications.

Systems that process and store big data have become a common component of data management architectures in organizations.

Big data is often characterized by the 3Vs: the large volume of data in many environments, the wide variety of data types stored in big data systems and the velocity at which the data is generated, collected and processed.

These characteristics were first identified by Doug Laney, then an analyst at Meta Group Inc., in 2001; Gartner further popularized them after it acquired Meta Group in 2005. More recently, several other Vs have been added to different descriptions of big data, including veracity, value and variability.

[<https://searchdatamanagement.techtarget.com/definition/big-data>]

## Big data, another explanation...

Big Data is also data but with a huge size. Big Data is a term used to describe a collection of data that is huge in volume and yet growing exponentially with time. In short such data is so large and complex that none of the traditional data management tools are able to store it or process it efficiently.

A single Jet engine can generate 10+ terabytes of data in 30 minutes of flight time. With many thousand flights per day, generation of data reaches up to many Petabytes.

BigData could be found in three forms:

- Structured (e.g. employee table in database)
- Unstructured (e.g. output from Google search)
- Semi-structured (e.g. course student data in XML file).

[<https://www.guru99.com/what-is-big-data.html>]

# Big Data

## Big Data is characterized by

- a collection of huge data sets (**Volume**),
- generated very rapidly (**Velocity**) and
- with a great diversity of data types (**Variety**).

Because of the massive amount of data and the variety of its sources, another characteristic of Big Data is

- the inherent error, noise and induced bias of erratic data (**Veracity**).

The original three Vs (Volume, Velocity and Variety) were introduced in 2001 by Doug Laney from Metagroup.

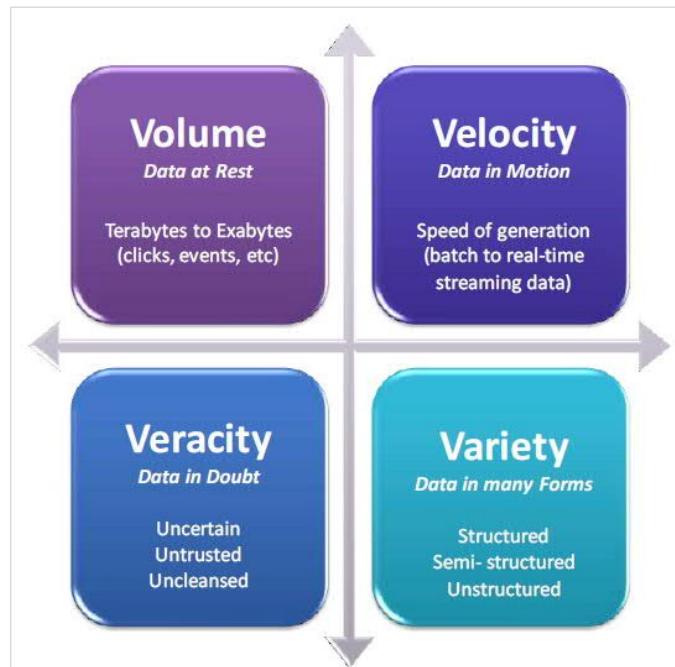
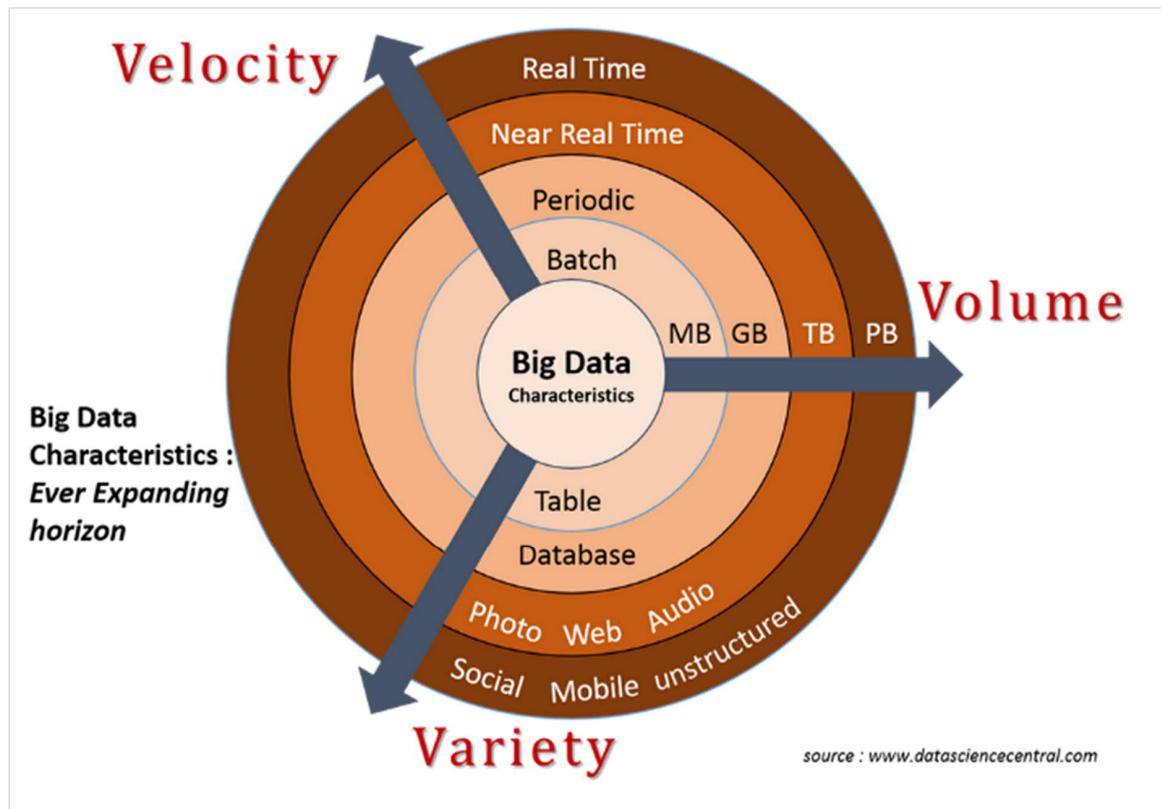
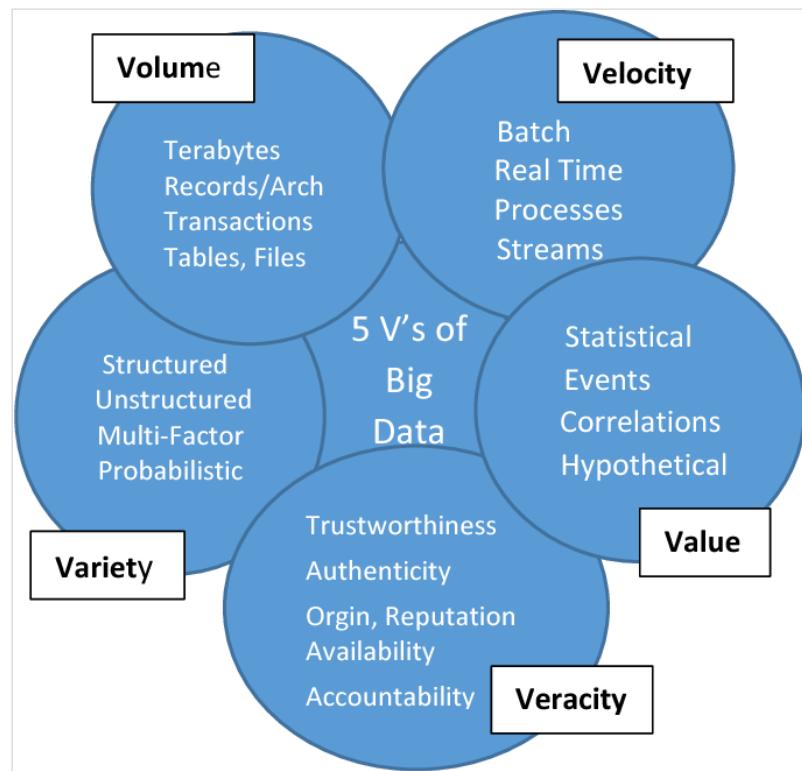
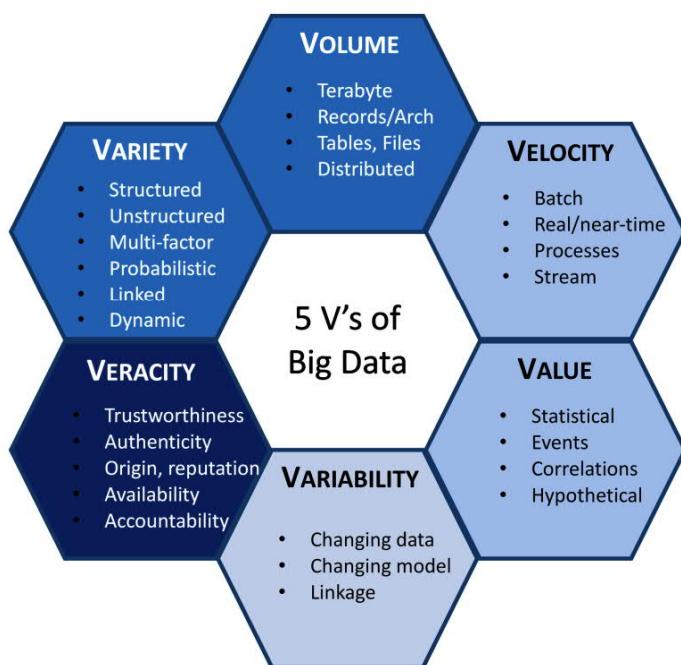


Figure 1 The four Vs of Big Data



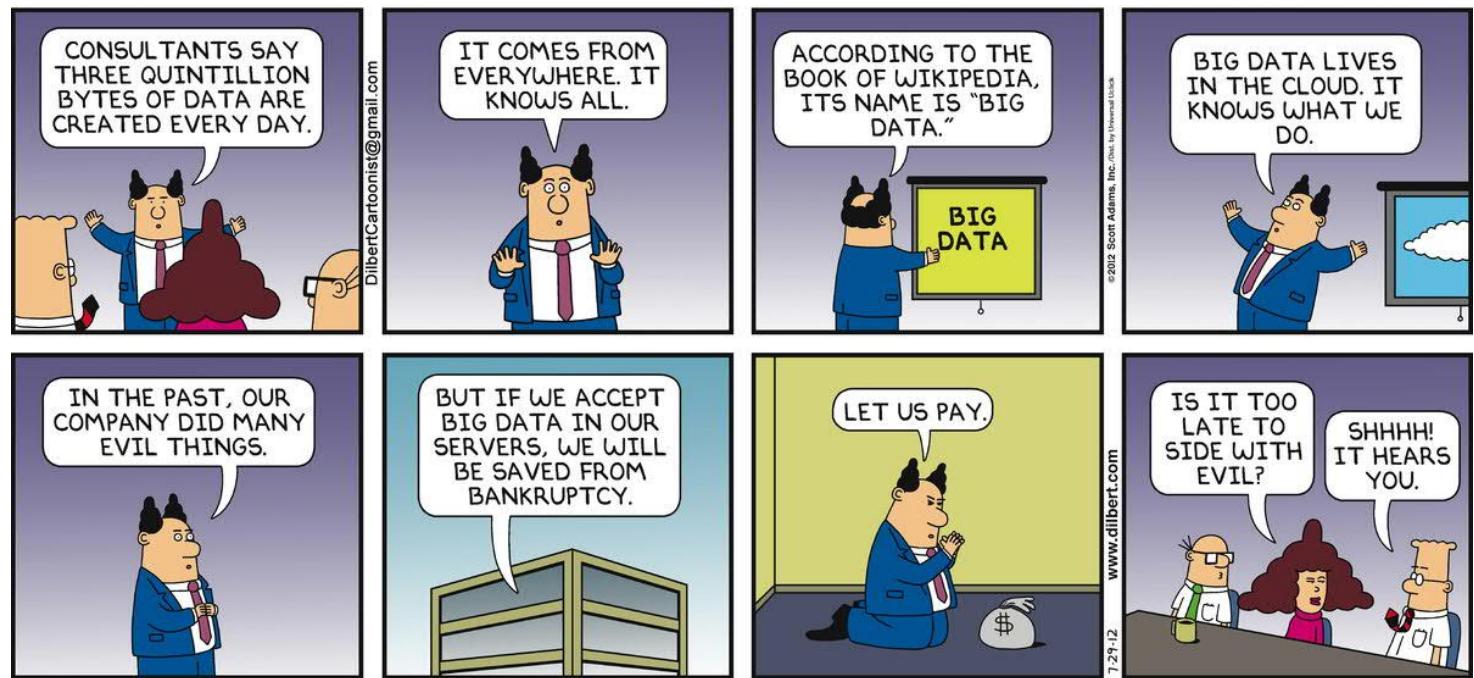


*Figure 1. The five V's of Big Data*  
(Adapted from ("IBM big data platform - Bringing big data to the Enterprise," 2014))



## DILBERT

BY SCOTT ADAMS



## Big Data in business and science

Examples show the massiveness of the amount of data generated every day in business:

- In 1 second: more than 2,100 Skype calls; 700 Instagram photos uploaded; 34,500 GB of Internet traffic; 53,900 Google searches; 121,400 YouTube videos viewed.
- 300 hours of video were uploaded to YouTube every minute (March 2015).
- Twitter serves around 650 million active users, who produce 9100 tweets every second.
- Facebook creates 10 terabytes ( $10 \times 10^{12}$  bytes) data every day, and Google produces 24 terabytes of data every day just from its search operations (Chang et al., 2014).

**Each day 2.5 exabytes ( $2.5 \times 10^{18}$  bytes) is created, so that 90% of the data in the world today has been created in the last two years alone.**

And in scientific research:

- CERN's Data Centre processes about one petabyte ( $10^{15}$  bytes) of data every day - the equivalent of around 210,000 DVDs. Its Large Hadron Collider, the largest particle accelerator, generates 40 terabytes per second.
- 32 petabytes of climate observations and simulations are conserved on the discovery supercomputing cluster in the NASA Center for Climate Simulation (NCCS) (Chen and Zhang, 2014).
- The Large Synoptic Survey Telescope (LSST) will record 30 exabytes ( $30 \times 10^{18}$  bytes) of image data in a single day (Chen and Zhang, 2014).

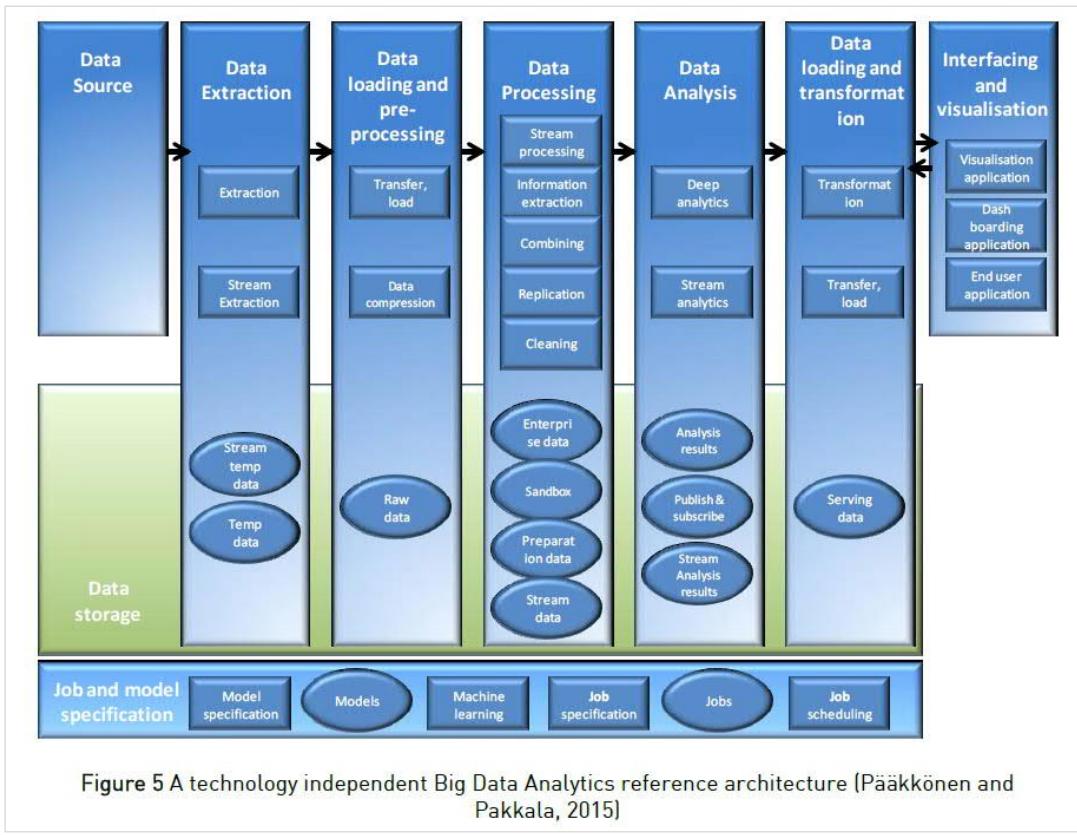
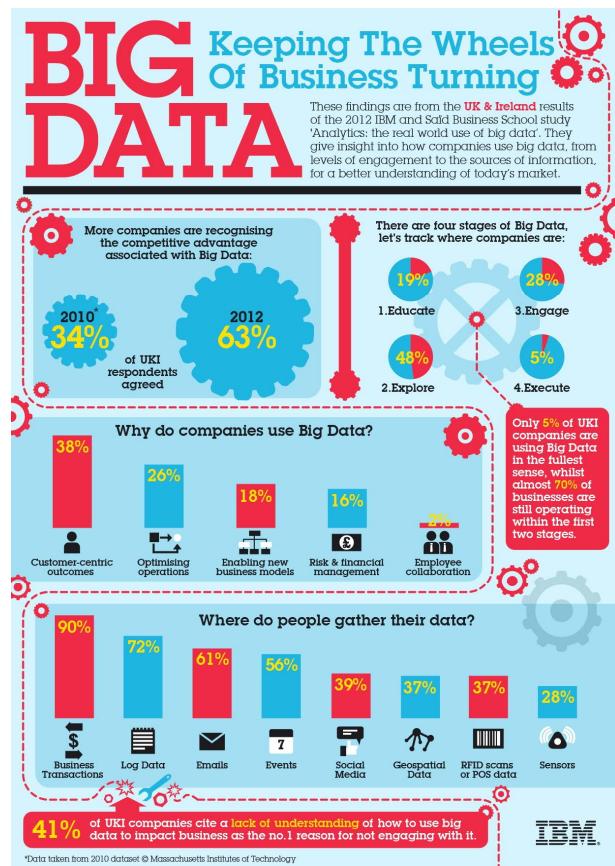
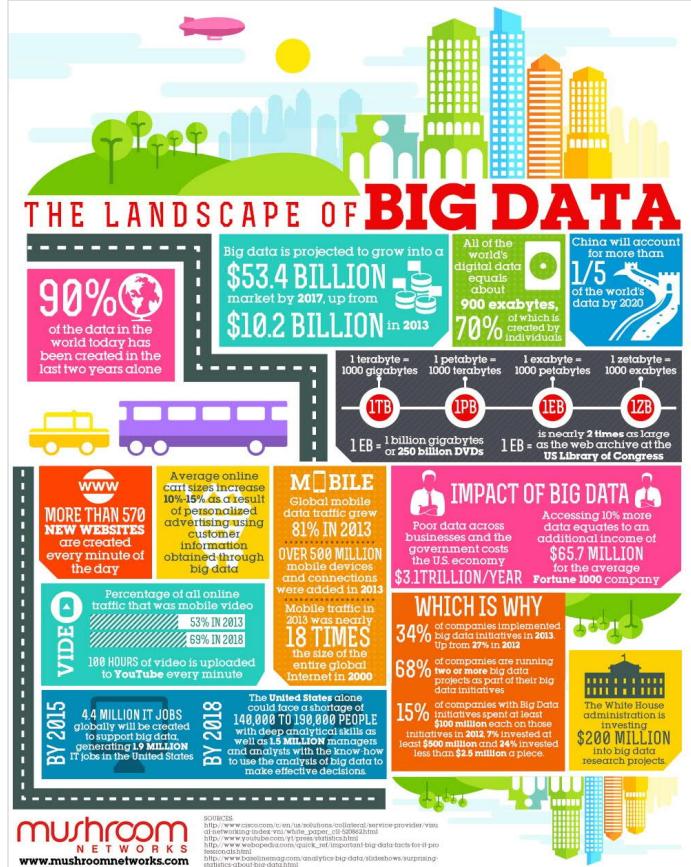


Figure 5 A technology independent Big Data Analytics reference architecture (Pääkkönen and Pakkala, 2015)





TUNI \* COMP.SE.100-EN Introduction to Sw Eng

18.11.2020 63

## Big data challenges [Datamation, 2017]

- Dealing with data growth (storing)
- Generating insights in a timely manner
- Recruiting and retaining big data talent
- Integrating disparate data sources
- Validating data
- Securing big data
- Organizational resistance.

For example, USAF handles 92 TB of weather data every day in 2019.

# Benefits of big data

Big data technologies can provide many benefits such as data accessibility, productivity of business processes, and cost reduction to private via public sector.

Big data technology increases data accessibility by:

- Unlocking significant value by making information transparent;
- Creating and storing transactional data in digital form;
- Reducing time for finding/accessing the correct data.

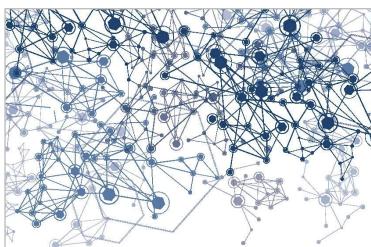
Big data technology improves productivity by:

- Real-time monitoring and forecasting of events that impact either business performance or operations;
- Timely insights from the vast amount of data;
- Identifying significant information that can improve decision quality or minimize risks;
- Creating new service models using big data analytics.

Big data technology reduces cost by:

- Scale-out of data storage;
- Identifying and reducing inefficiencies.

[ITU]



**Big Data:  
Big today, normal tomorrow**

ITU-T Technology Watch Report  
November 2013

This technology watch report looks at current examples and applications associated with the big data paradigm, identifies opportunities among them by describing their characteristics, and highlights some of the techniques enabling the leverage of big data. As with many emerging technologies, several challenges need to be addressed to fully realize the potential of big data. This report also highlights the challenges and opportunities related to the ITU-T work programme. The main findings of the report are summarized below. A detailed analysis related to the ITU-T work programme are described in the final section of this report.



[Standards](#) [All about ISO](#) [Taking part](#) [Store](#) [Search](#) [EN](#)



ICS > 35 > 35.020

# ISO/IEC 20546:2019

## Information technology – Big data – Overview and vocabulary

**BUY THIS STANDARD**

<b>FORMAT</b>	<b>LANGUAGE</b>
<input checked="" type="checkbox"/> PDF + EPUB	English <input type="button" value="▼"/>
PAPER	English <input type="button" value="▼"/>

CHF 58 

**ABSTRACT** [PREVIEW](#)

This document provides a set of terms and definitions needed to promote improved communication and understanding of this area. It provides a terminological foundation for big data-related standards.

This document provides a conceptual overview of the field of big data, its relationship to other technical areas and standards efforts, and the concepts ascribed to big data that are not new to big data.

# Big data

We live in a data-rich world, in which masses of data, known as big data, are generated every day.

An online search or booking, a credit card purchase, an ID scan, a grocery shopping list, social media post, medical record, health monitor, all contain data which can be gathered and analyzed to gain useful insights and improve products and services.

Artificial intelligence (AI) technologies, including algorithms and machine learning are able to make sense of big data in real time. These technologies are evolving rapidly and being used in a growing number of industries, from financial and healthcare to smart manufacturing, intelligent transport systems and self-driving vehicles, as decisions that were once made by human experience are gradually be made by machine analysis of huge amounts of big data.

<https://blog.iec.ch/2019/04/the-need-for-big-data-standards/>

## Big Data, 4V

### Big Data is characterized by

- a collection of huge data sets (**Volume**),
- generated very rapidly (**Velocity**) and
- with a great diversity of data types (**Variety**).

Because of the massive amount of data and the variety of its sources, another characteristic of Big Data is

- the inherent error, noise and induced bias of erratic data (**Veracity**).

The original three Vs (Volume, Velocity and Variety) were introduced in 2001 by Doug Laney from Metagroup.

Määrä, kertymisnopeus, luotettavuus, vaihtelevuus.

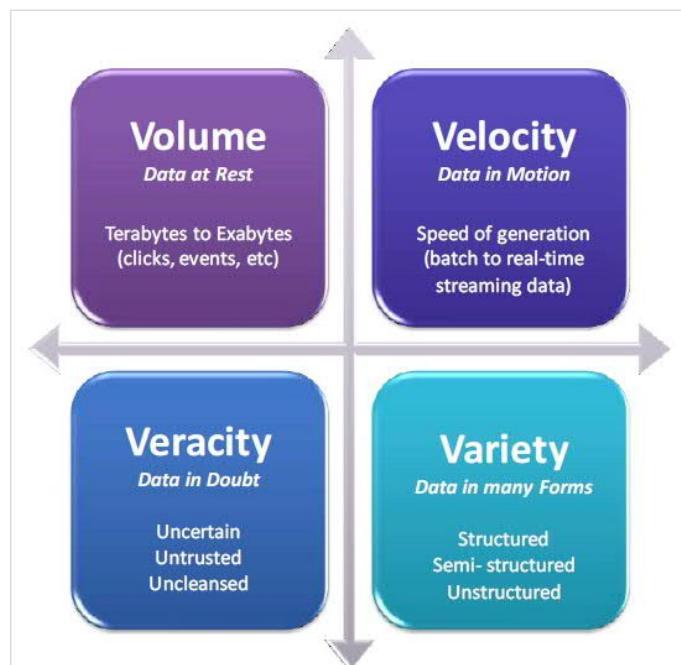
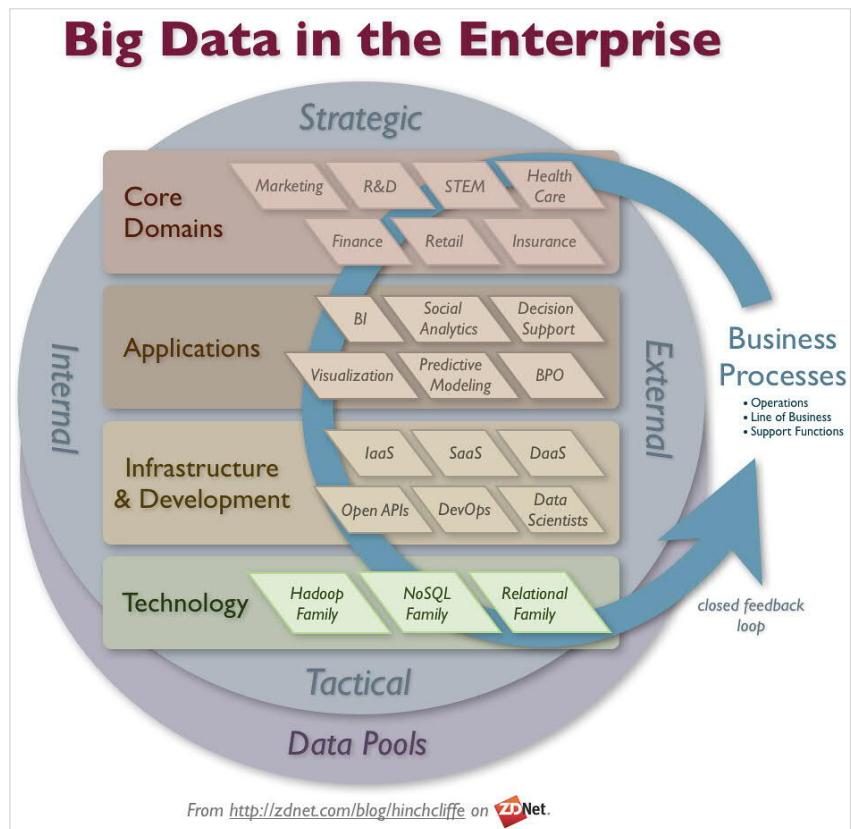


Figure 1 The four Vs of Big Data

**With Business Intelligence tools you can do data mining to get data for business decisions and analyses.**



## Mash-up = mashup

A mash-up (sometimes spelled as one word, **mashup**) is a Web page or **application that integrates complementary elements from two or more sources**.

Mash-ups are often defined by the type of content that they aggregate.

A content mash-up, for example, brings together various types of content for presentation through an interface. **That content could include -- among other things -- text, data feeds, video and social updates.**

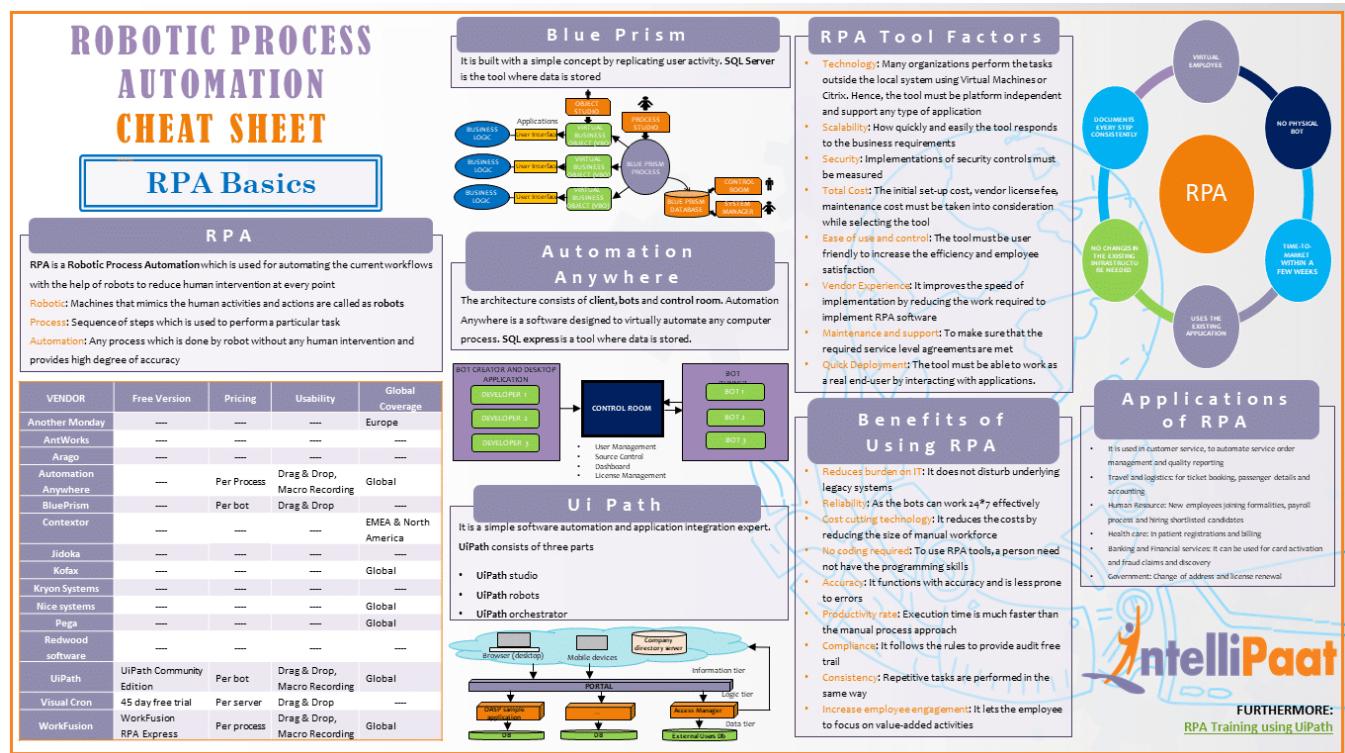
An enterprise mash-up typically **combines internal corporate data and applications with externally sourced data**, SaaS (software as a service) and Web content.

Business mash-ups might also provide **integration with the business computing environment**, data governance, business intelligence (BI)/ business analytics (BA), more sophisticated programming tools and more stringent security measures.

[[whatis.techtarget.com/definition/mash-up](http://whatis.techtarget.com/definition/mash-up)]

So, a mash-up is an application with a combination of different data sources.

Mashup = web application hybrid.



# COMP.SE.100-EN (ItSE) Introduction to Software Engineering

Lecture 11, 18.11.2020

Tensu: remember to pause  
Zoom lecture recording

Zoom lecture break, 10 minutes stretching, walking, etc.

# Internet of Things (IoT)

## IoT, IoE

- IoT = Internet of Things
- IoE = Internet of Everything
- M2M = machine to machine

# IoT

Internet of Things, IoT, (FI: esineiden internet)

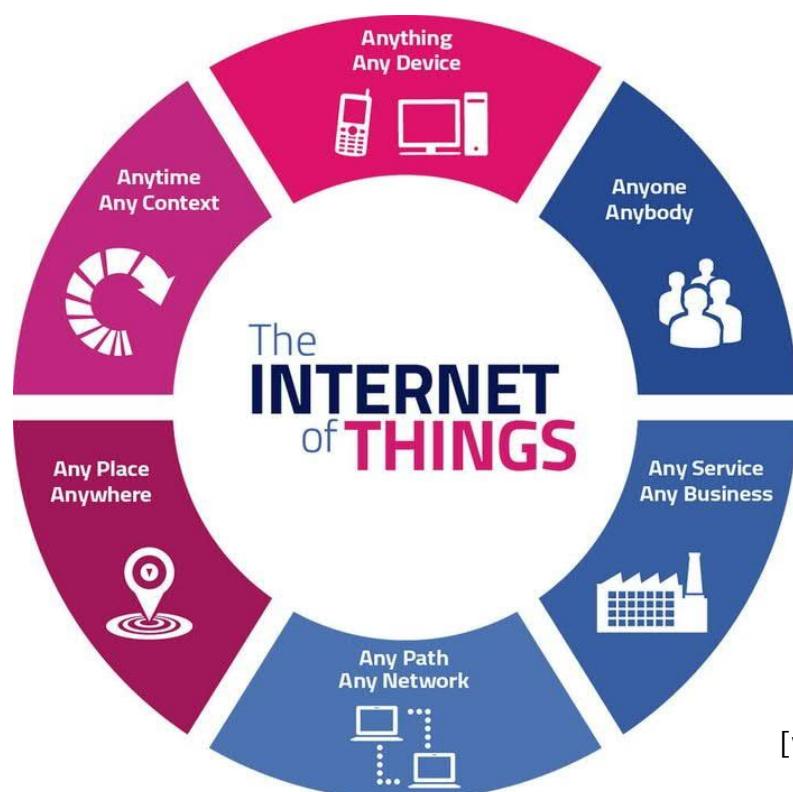
"The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the **ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.**"

—An unnecessarily technical explanation of IoT

In the Internet of Things, all the things that are being connected to the internet can be put into three categories:

- Things that collect information and then send it.
- Things that receive information and then act on it.
- Things that do both.

[www.iotforall.com]



[www.ubuntupit.com/]

# Some IoT protocols... there are many...

Rather than trying to fit all of the IoT Protocols on top of existing architecture models like OSI Model, we have broken the protocols into the following layers to provide some level of organization: (examples)

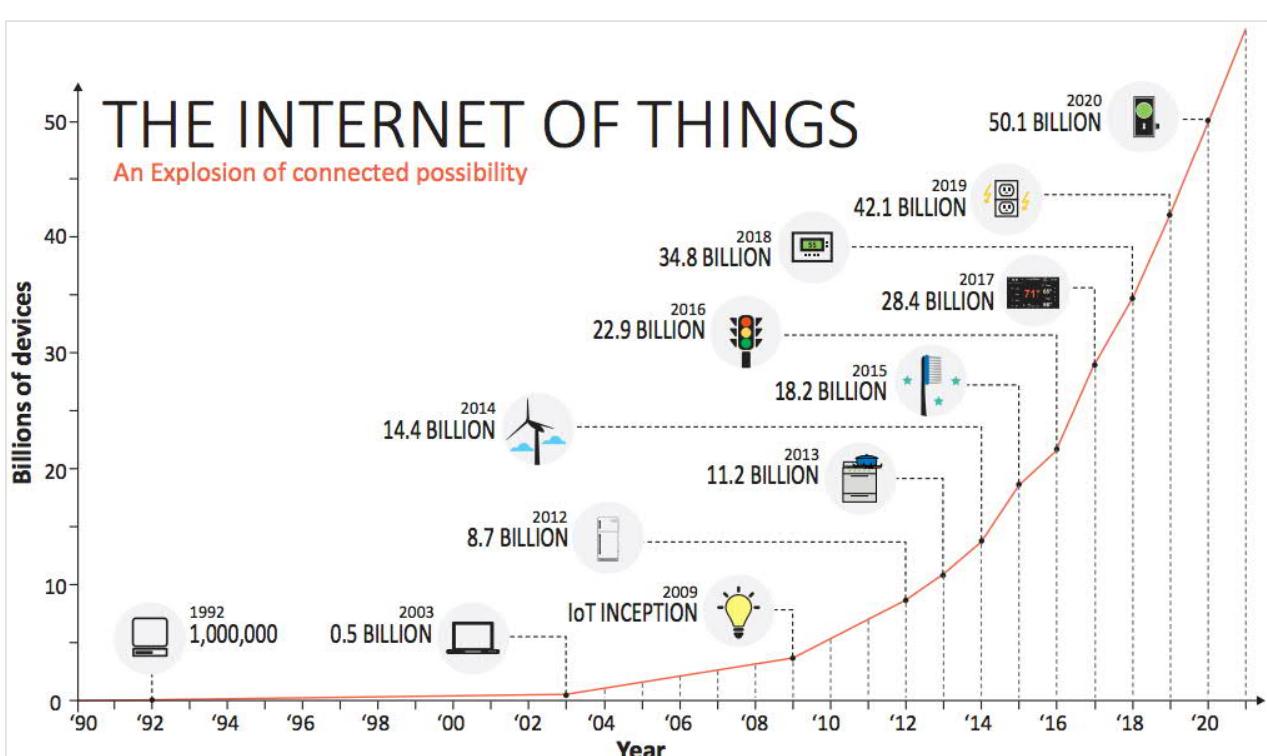
- Infrastructure (ex: 6LowPAN, IPv4/IPv6, RPL)
- Identification (ex: EPC, uCode, IPv6, URIs)
- Comms / Transport (ex: Wifi, Bluetooth, LPWAN)
- Discovery (ex: Physical Web, mDNS, DNS-SD)
- Data Protocols (ex: MQTT, CoAP, AMQP, Websocket, Node)
- Device Management (ex: TR-069, OMA-DM)
- Semantic (ex: JSON-LD, Web Thing Model)
- Multi-layer Frameworks (ex: Alljoyn, IoTivity, Weave, Homekit).

[<https://www.postscapes.com/internet-of-things-protocols/>]

18.11.2020

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

79



[<https://www.getzephyr.com/resources/whitepapers/iot-and-its-impact-testing>]

[Standards](#) [All about ISO](#) [Taking part](#) [Store](#) [Search](#) [EN](#)

**ISO**

**ICS > 35 > 35.020**

## ISO/IEC 20924:2018

Information technology – Internet of Things (IoT) – Vocabulary

The electronic version of this International Standard can be downloaded from the ISO/IEC Information Technology Task Force (ITTF) web site.

**ABSTRACT** [PREVIEW](#)

ISO/IEC 20924:2018(E) provides a definition of Internet of Things along with a set of terms and definitions forming a terminology foundation for the Internet of Things

**BUY THIS STANDARD**

FORMAT	LANGUAGE
<input checked="" type="checkbox"/> PDF	English <a href="#">▼</a>
PAPER	English <a href="#">▼</a>

CHF 58 [BUY](#)

**ISO**

**ICS > 35 > 35.020**

## ISO/IEC 21823-1:2019

Internet of things (IoT) – Interoperability for internet of things systems – Part 1: Framework

**BUY THIS STANDARD**

FORMAT	LANGUAGE
<input checked="" type="checkbox"/> PDF	English <a href="#">▼</a>
PAPER	English <a href="#">▼</a>

CHF 118 [BUY](#)

[Standards](#) [All about ISO](#) [Taking part](#) [Store](#) [Search](#) [EN](#)

**ISO**

**ICS > 35 > 35.020**

## ISO/IEC TR 22417:2017

Information technology – Internet of things (IoT) use cases

**ABSTRACT** [PREVIEW](#)

ISO/IEC TR 22417:2017(E) This technical report identifies IoT scenarios and use cases based on real-world applications and requirements. The use cases provide a practical context for considerations on interoperability and standards based on user experience. They also clarify where existing standards can be applied and highlight where standardization work is needed.

**GENERAL INFORMATION** [▼](#)

**BUY THIS STANDARD**

FORMAT	LANGUAGE
<input checked="" type="checkbox"/> PDF	English <a href="#">▼</a>
PAPER	English <a href="#">▼</a>

CHF 198 [BUY](#)

[Standards](#) [All about ISO](#) [Taking part](#) [Store](#) [Search](#) [EN](#)

**ISO**

**ICS > 35 > 35.020**

## ISO/IEC 30141:2018

Internet of Things (IoT) – Reference Architecture

**GENERAL INFORMATION** [▼](#)

Status :  Published Publication date : 2018-08  
Edition : 1 Number of pages : 77  
Technical Committee : ISO/IEC/TC 1/SC 41 Internet of Things and related technologies  
ICS : 35.020 Information technology (IT) in general

**BUY THIS STANDARD**

FORMAT	LANGUAGE
<input checked="" type="checkbox"/> PDF	English <a href="#">▼</a>
PAPER	English <a href="#">▼</a>

CHF 198 [BUY](#)

## CD 20924, Information technology – Internet of Things – Definition and Vocabulary

### 3.29 , IoT Device

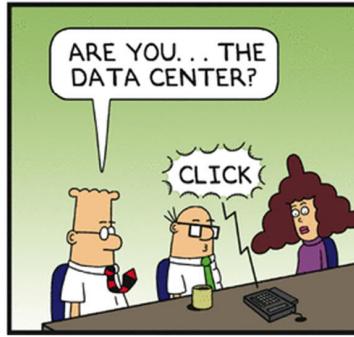
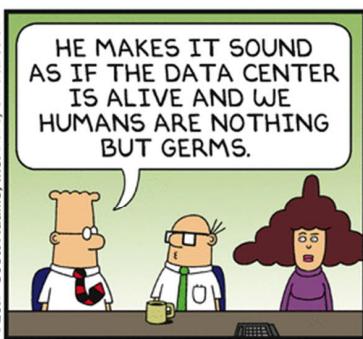
a component that can be a single or a combination of the following elements:

- Sensors, which provide information about the Physical Entity
- Tags, which are used to identify Physical Entities
- Actuators, which can modify the physical state of a Physical Entity.

### 3.32 , IoT system

a system that is comprised of functions that provide the system the capabilities for identification, sensing, actuation, communication, and management, and applications and services to a user.

## DILBERT





IEC White Paper  
IoT 2020: Smart and secure IoT platform

## Stakeholders

Biz Decision Makers  
System Engineers  
Product Managers

Why

System Engineers  
Product Managers  
System Architects

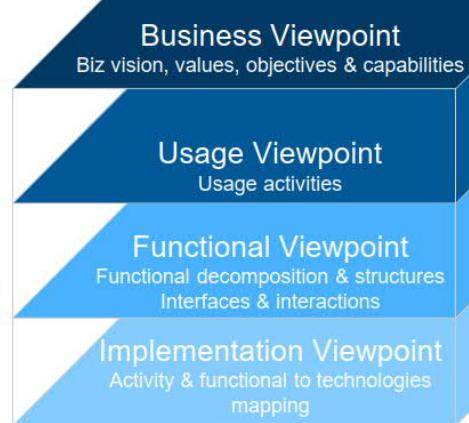
Verb

What

Architects  
Engineers  
Developers  
Integrators  
Deployment  
Operations

Noun

How



**Figure 2-3 | IIC Industrial Internet Reference Architecture**



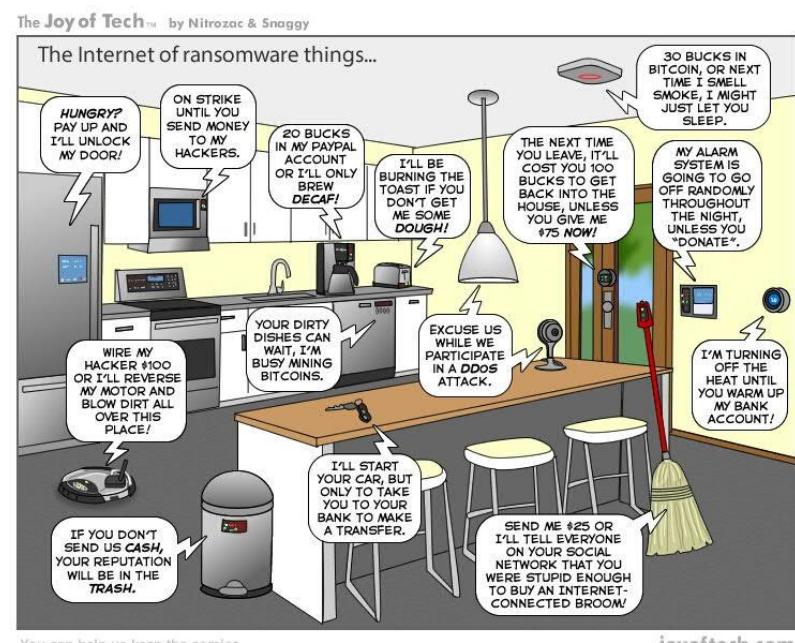
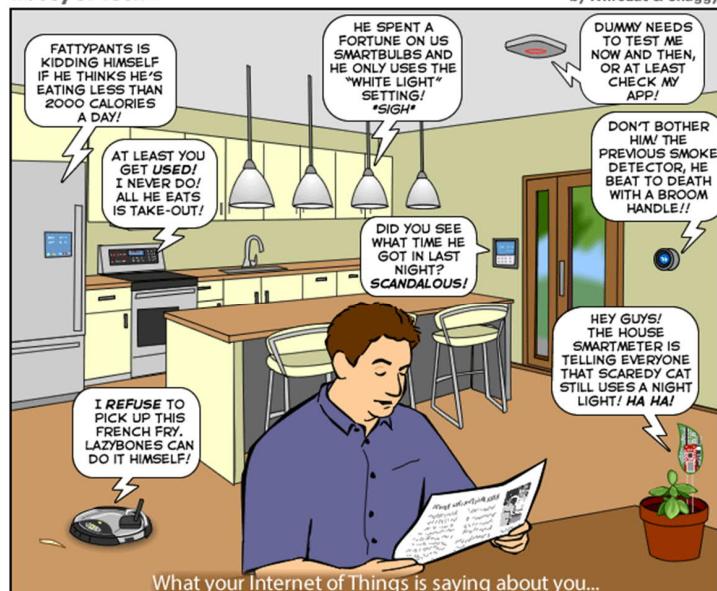
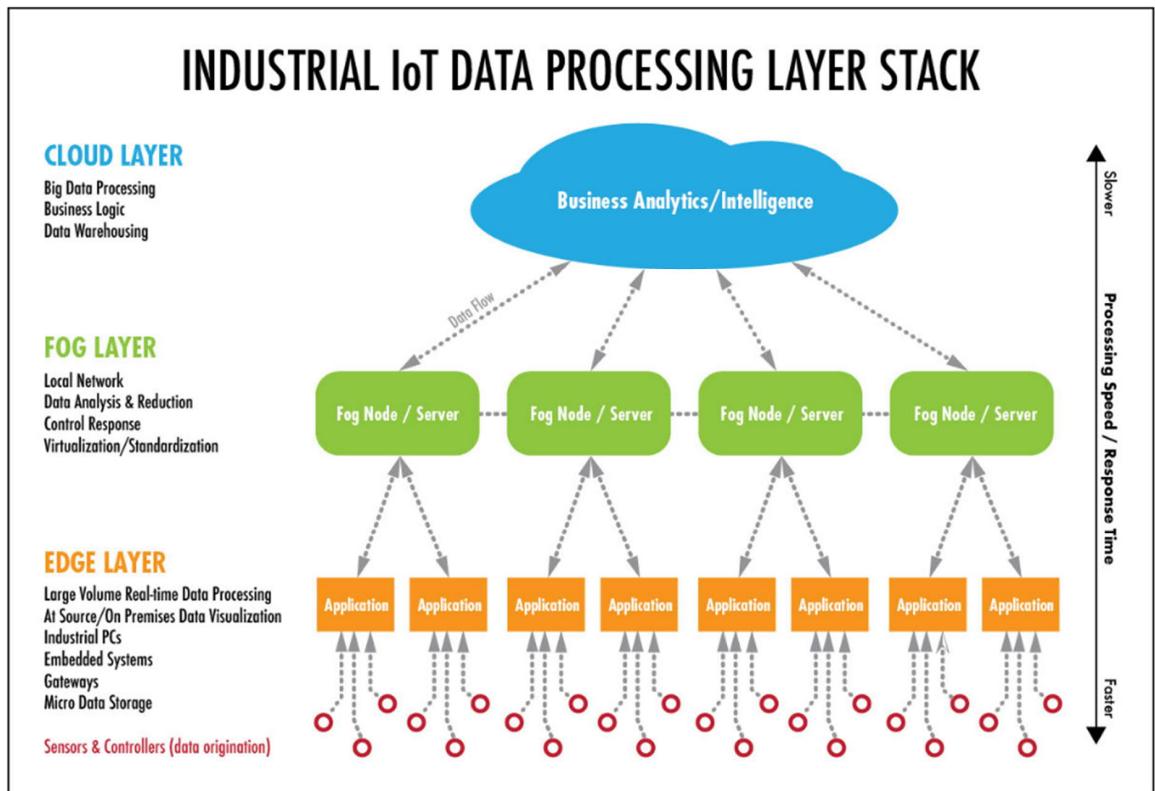
## Standardization Issues for the Internet of Things

### 4. Comparison of standards considered (1/2)

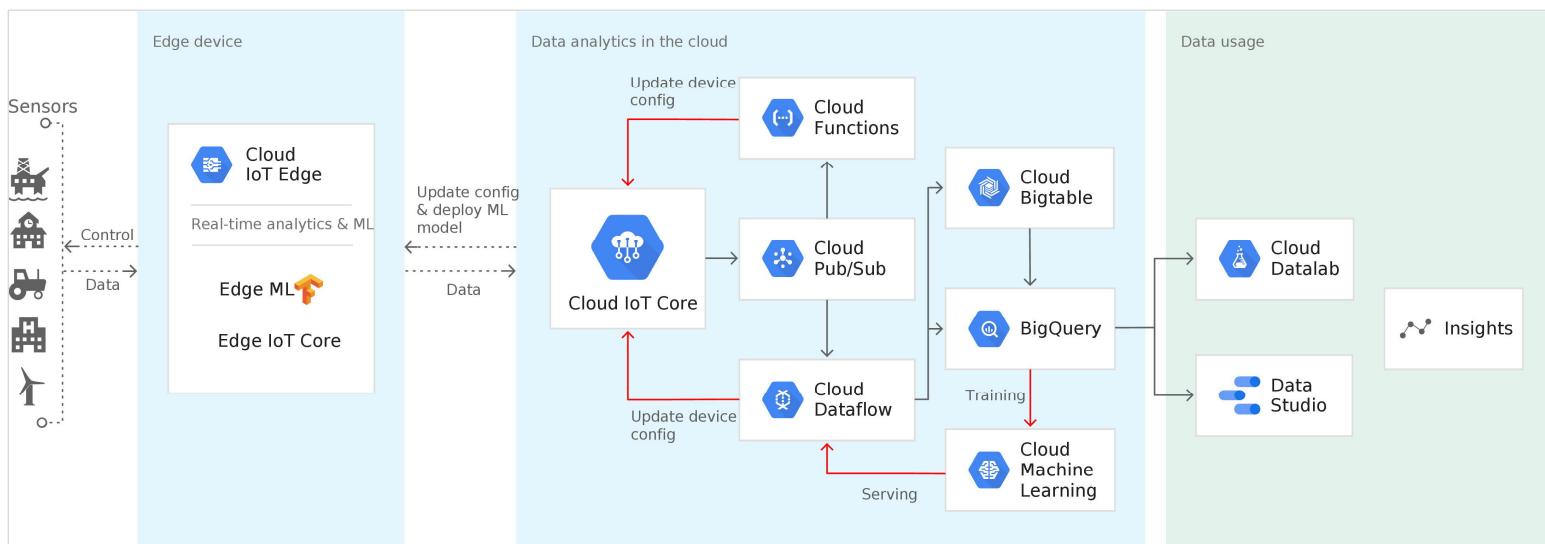
According to the full content of available documents studied, several comparison criteria were defined. Using them, common and unique parts of these documents could be identified.



IS issues / Organization	ITU	ISO/IEC	IEEE
Terms and definitions	Own relevant terms and definitions	Own relevant terms and definitions	Own relevant terms and definitions
IoT requirements	General and specific, different from others	General and specific, different from others	General and specific, different from others
IoT capabilities	Disclosed in detail in general and particular cases	More focused on general cases	More focused on particular cases
IoT specifics	Reviewed from different points of view	Reviewed from different points of view	Reviewed from the perspective of certain issues
IoT threat classification	A generic and concrete version with examples	A generic version with examples	Not defined yet



# Review of Google IoT Platform



Cloud IoT Core is entirely manageable service that allows to connect, configure, and receive data from a good many devices quickly and safely. Using Cloud Pub/Sub, the Core can merge data from decentralized devices into a single global system.

[<https://habr.com/en/post/442710/>]

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

18.11.2020

89

## Internet of Things security: A survey [Journal of Network and Computer Applications Volume 88, 15 June 2017, Pages 10-28]

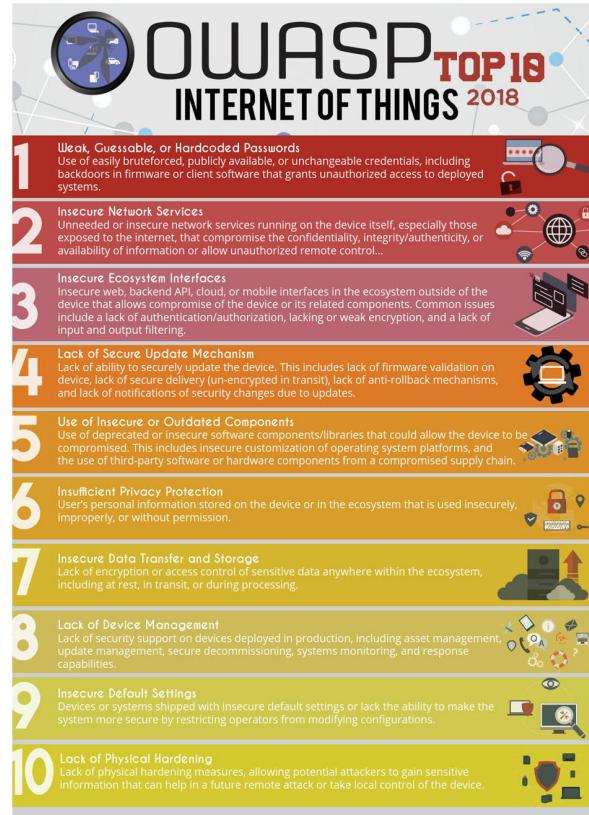
- The Internet of things (IoT) has recently become an important research topic because it integrates various sensors and objects to communicate directly with one another without human intervention. The requirements for the large-scale deployment of the IoT are rapidly increasing with a major security concern. This study focuses on the state-of-the-art IoT security threats and vulnerabilities by conducting an extensive survey of existing works in the area of IoT security. The taxonomy of the current security threats in the contexts of application, architecture, and communication is presented. This study also compares possible security threats in the IoT. We discuss the IoT security scenario and provide an analysis of the possible attacks. Open research issues and security implementation challenges in IoT security are described as well. This study aims to serve as a useful manual of existing security threats and vulnerabilities of the IoT heterogeneous environment and proposes possible solutions for improving the IoT security architecture.

## <https://owasp.org/> The Open Web Application Security Project

If you have some IoT devices at home, remember at least a few basic things;

- change default password
- keep IoT in their own sub-network, not at the same net as your other devices.

Pessimist's basic rule: you never know what other data IoT devices send, and where. ; -)



## Edge computing vs. IoT edge

Note that "old" Edge computing is not necessarily the same as IoT edge.

Edge computing is a method of optimizing cloud computing systems by performing data processing at the edge of the network, near the source of the data.

In today's IoT system architectures, the concept of the "edge" refers to the aspect that comprises the operational domain of the overall IoT system. (comprise = consists of)

## IoT edge [IEC: IoT 2020: Smart and secure IoT platform]

### 2.1.2 Edge

In today's IoT system architectures, the concept of the "edge" refers to the aspect that comprises the operational domain of the overall IoT system.

The edge typically consists of sensors, controllers, actuators, tag and tag readers, communication components, gateways and the physical devices themselves. The edge is where operational components connect, communicate and interact with each other, with the platform and in some cases directly with components in other edges.

The edge can be as small as a single physical device with a direct connect to a platform, or as large as a manufacturing plant comprising all manufacturing equipment with a comprehensive communications functional component and edge computing platform, or anything in between. Within the edge, there may or may not be a platform to support processing.

## Edge computing (FI: reunalaskenta)

Gartner defines edge computing as "a part of a distributed computing topology in which information processing is located close to the edge – where things and people produce or consume that information."

At its basic level, edge computing brings computation and data storage closer to the devices where it's being gathered, rather than relying on a central location that can be thousands of miles away. This is done so that data, especially real-time data, does not suffer latency issues that can affect an application's performance. In addition, companies can save money by having the processing done locally, reducing the amount of data that needs to be processed in a centralized or cloud-based location.

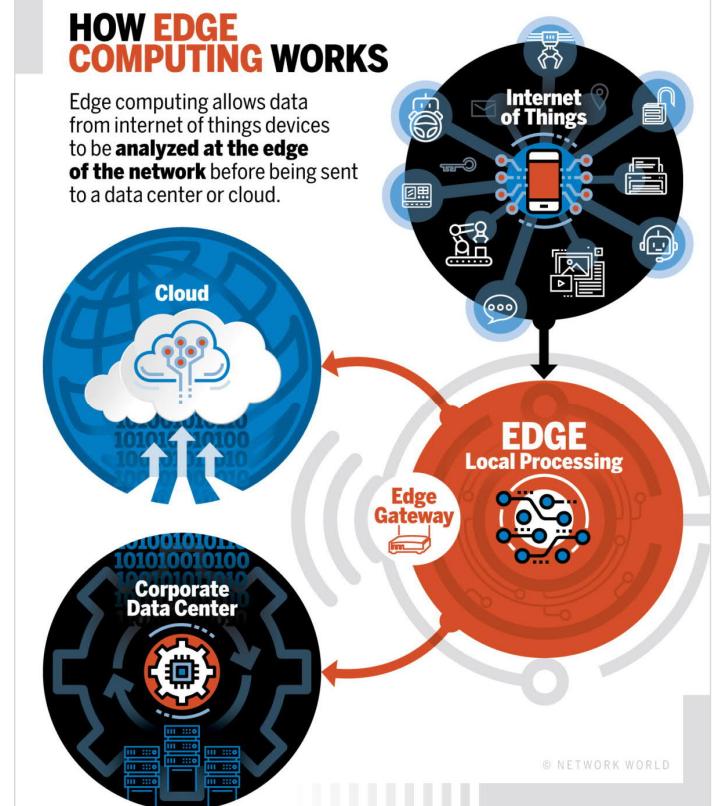
Edge computing was developed due to the exponential growth of IoT devices, which connect to the internet for either receiving information from the cloud or delivering data back to the cloud. And many IoT devices generate enormous amounts of data during the course of their operations.

[<https://www.networkworld.com/>]

# Edge computing

Around the world, carriers are deploying 5G wireless technologies, which promise the benefits of high bandwidth and low latency for applications, enabling companies to go from a garden hose to a firehose with their data bandwidth. Instead of just offering the faster speeds and telling companies to continue processing data in the cloud, many carriers are working edge-computing strategies into their 5G deployments in order to offer faster real-time processing, especially for mobile devices, connected cars and self-driving cars.

[<https://www.networkworld.com/>]

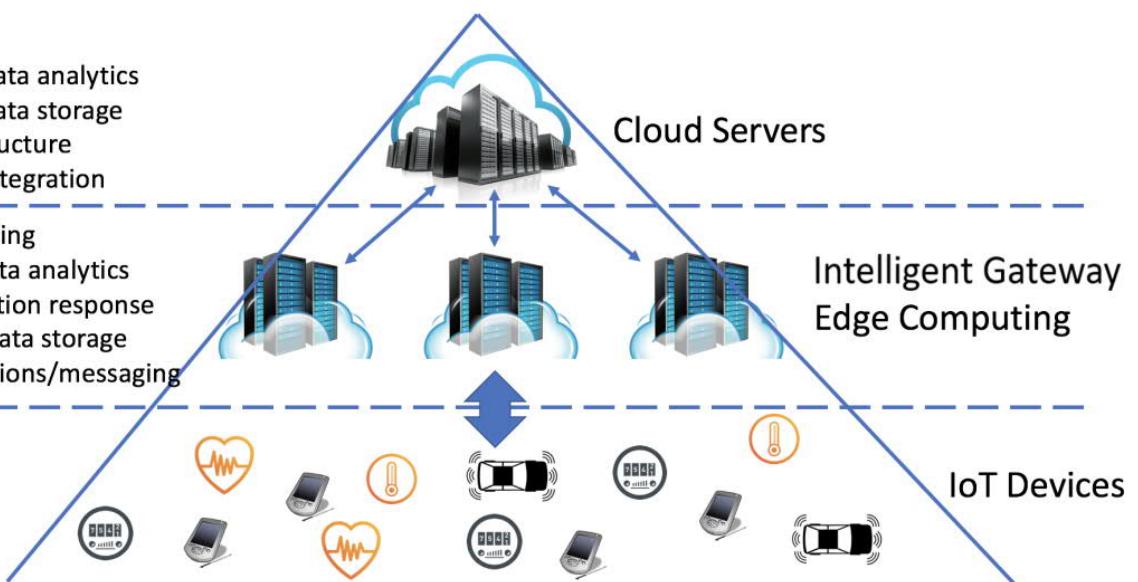


TUNI \* COMP.SE.100-EN Introduction to Sw Eng

18.11.2020 95

## [A Survey on the Edge Computing for the Internet of Things, 2018]

- Reporting
  - Long-term data analytics
  - Long-term data storage
  - Data infrastructure
  - Enterprise integration
- 
- Data processing
  - Real-time data analytics
  - Real-time action response
  - Temporary data storage
  - Communications/messaging
- 
- Data source
  - Messaging



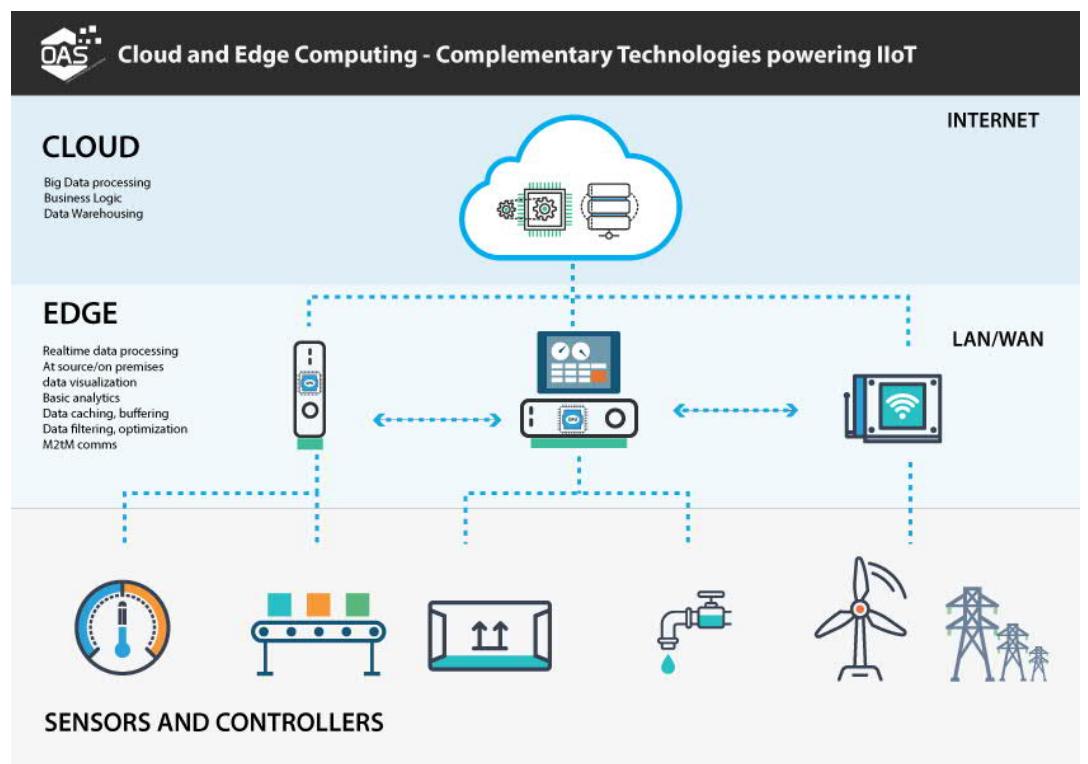
**FIGURE 6. Layer architecture of edge computing-based IoT.**

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

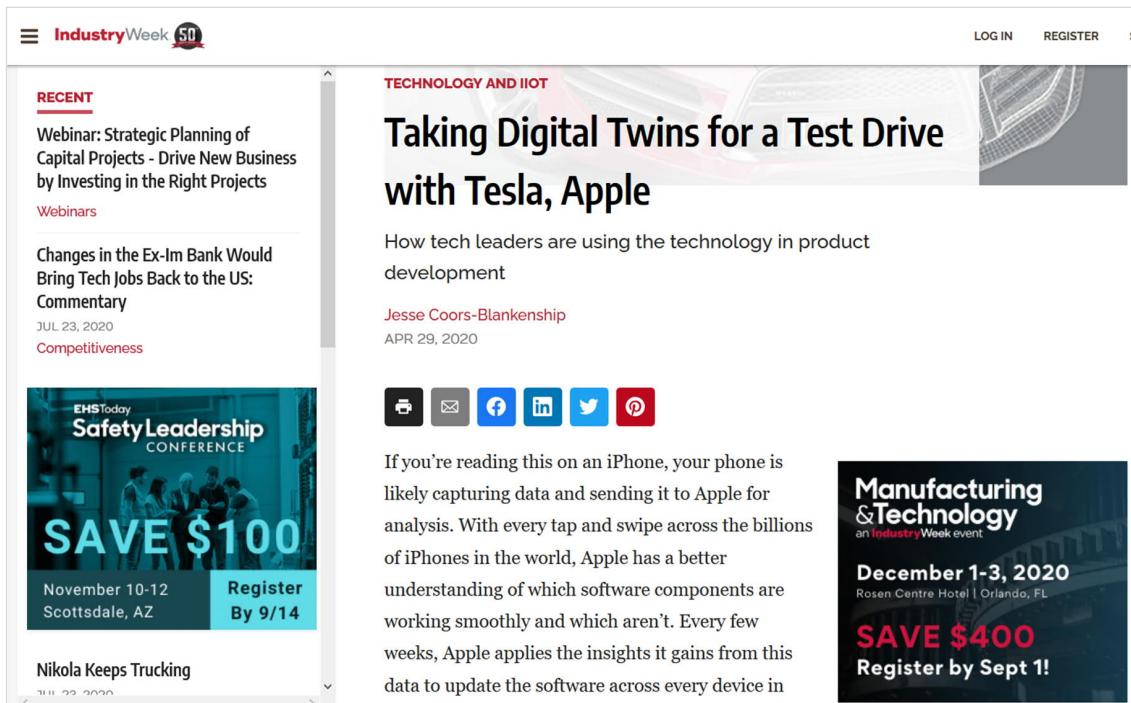
18.11.2020 96

The 'edge' refers to computing infrastructure that exists close to the origin sources of data. It is distributed IT architecture and infrastructure where data is processed at the periphery of the network, as close to the originating source as possible.

Edge computing is a method of optimizing cloud computing systems by performing data processing at the edge of the network, near the source of the data.



## Digital twins, example



The screenshot shows a news article from IndustryWeek titled "Taking Digital Twins for a Test Drive with Tesla, Apple". The article discusses how tech leaders are using digital twins in product development, specifically mentioning Tesla and Apple. It includes a sub-headline: "How tech leaders are using the technology in product development". The author is Jesse Coors-Blankenship, and the date is APR 29, 2020. Below the article are social sharing icons for Print, Email, Facebook, LinkedIn, Twitter, and Pinterest.

**RECENT**

Webinar: Strategic Planning of Capital Projects - Drive New Business by Investing in the Right Projects  
[Webinars](#)

Changes in the Ex-Im Bank Would Bring Tech Jobs Back to the US: Commentary  
JUL 23, 2020  
[Competitiveness](#)

**TECHNOLOGY AND IIOT**

**Taking Digital Twins for a Test Drive with Tesla, Apple**

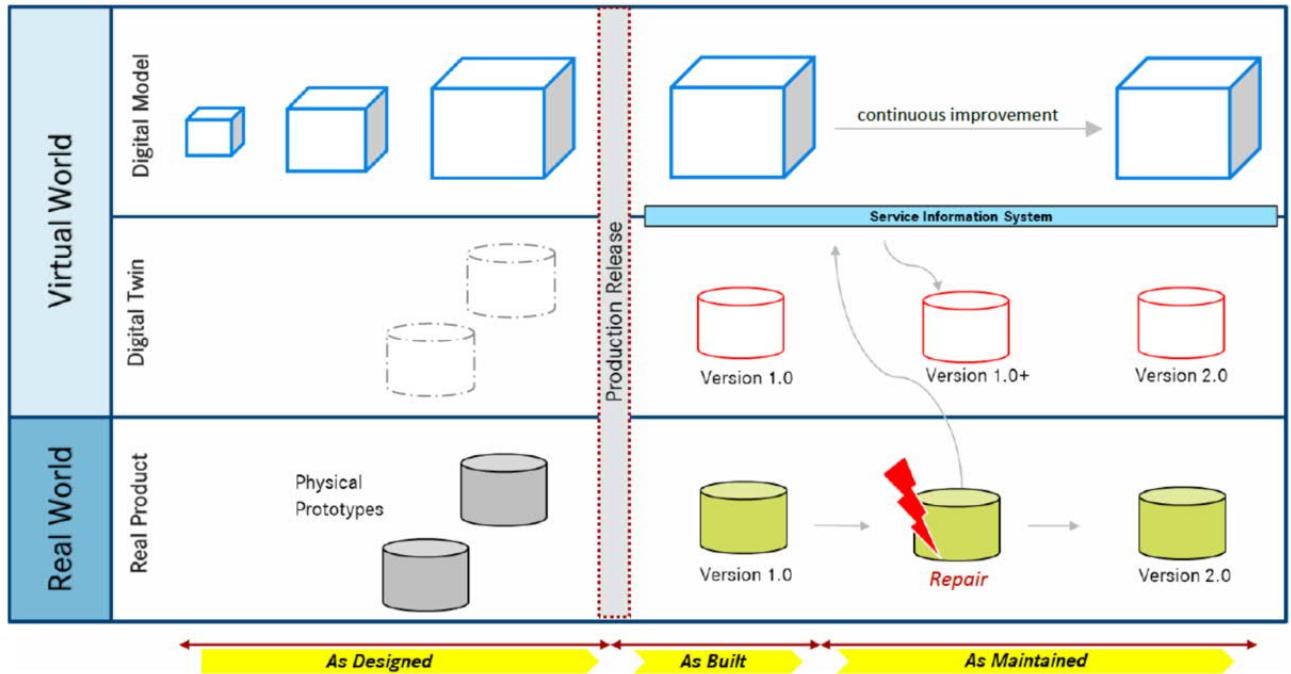
How tech leaders are using the technology in product development

Jesse Coors-Blankenship  
APR 29, 2020

**EHS Today Safety Leadership Conference**  
**SAVE \$100**  
November 10-12  
Scottsdale, AZ  
Register By 9/14

Nikola Keeps Trucking

**Manufacturing & Technology**  
an IndustryWeek event  
**December 1-3, 2020**  
Rosen Centre Hotel | Orlando, FL  
**SAVE \$400**  
Register by Sept 1!



**Figure 2. Visualisation of the Digital Twin development process (Eigner, 2017)**

## Digital twins, Tesla

Digital twins are detailed, data-driven digital representations of products in the field. As more products come equipped with sensors, manufacturers gain the ability to collect data in the digital twin, enabling real-time analysis of product performance and conditions. By aggregating data from the digital twins of all their products in the field, manufacturers can gain performance insights at a scale not unlike that of iPhones and other consumer electronics.

Forward-thinking manufacturers are already doing this. Case in point, Tesla creates a digital twin of every vehicle it sells. Sensors from thousands of cars continuously stream data into each car's simulation in the factory, where Artificial Intelligence (AI) interprets the data and determines whether a car is working as intended or if it needs maintenance. For many maintenance issues, Tesla's software integrations are so thorough that problems can be fixed with software updates—for instance, adjusting the hydraulics to compensate for a rattling door. By merging AI and IoT, Tesla is able to constantly learn from the real world and optimize each of its cars individually, in real time.

[<https://www.industryweek.com/technology-and-iiot/article/21130033/how-digital-twins-are-raising-the-stakes-on-product-development>]

## Digital twins, Tesla example

If you make a product, you could create a digital twin of that product. Tesla does this. It retains and monitors a digital twin of every car it makes.

The idea of the digital twin isn't new – Forbes reports that it was first coined in 2002 by Michael Grieves at the University of Michigan.

Digital twins need data – lots of data. And then you need somewhere to store that data and enough processing power to make use of it.

We now live in an age where computing power is readily available in massive quantities through cloud services and data collection through IoT sensors makes it easy to collect everything you need to create a digital twin.

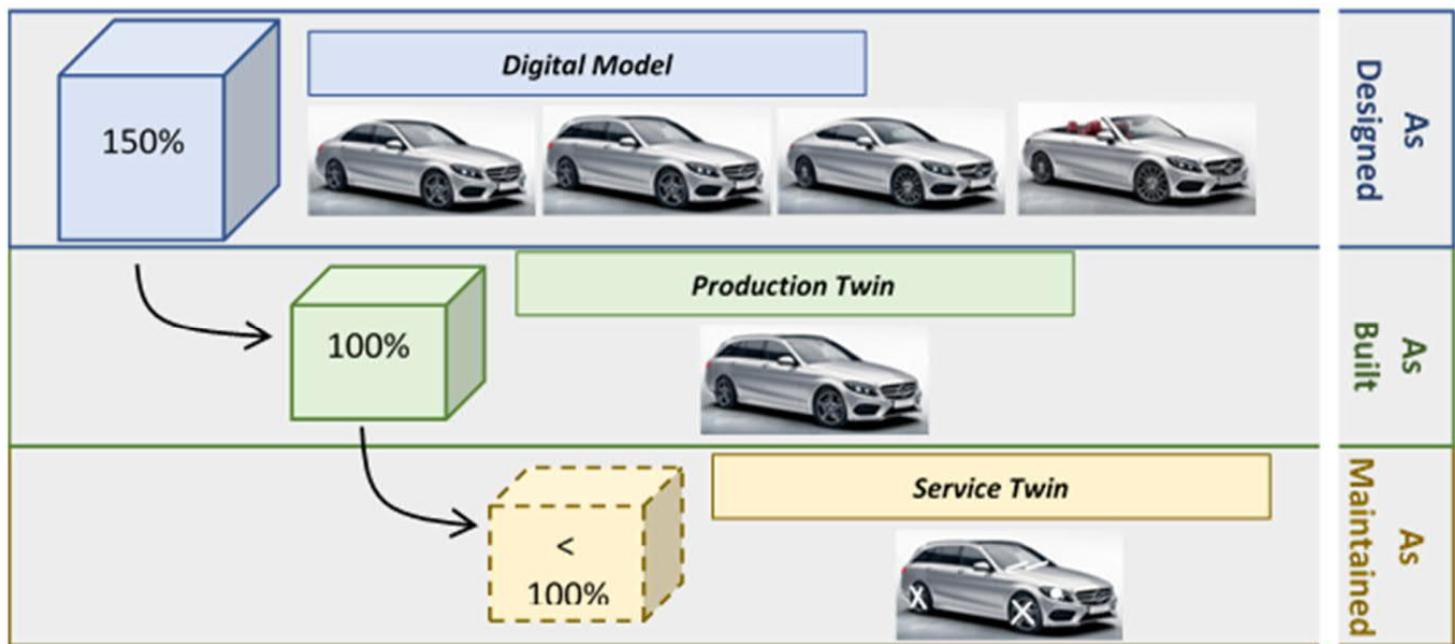
So, while the idea of the digital twin isn't new, our ability to apply it broadly is a recent phenomena.

[<https://www.lifehacker.com.au/2020/03/what-is-digital-twin-tesla/>]

## Digital twins, Tesla

Tesla is applying, basically, the same concept to its cars. Every car reports back on a daily bases its day experience and those data are used by simulation programs on the digital twin to discover possible anomalies and provide corrective actions. The multitude of digital twins, for Tesla as for GE, makes possible to learn from multiple experience. **Tesla declares that it gets the equivalent of 1.6 million miles "a day" of driving experience and this is fed back to each car in a continuous learning process.**

[<https://cmte.ieee.org/futuredirections/2018/01/16/the-rise-of-digital-twins/>]



**Figure 3. Distinction between digital model, Production and Service Twin**

## Digital twins

Aggregating the live data from thousands of products in the field, digital twins can simulate the performance and conditions faced by the average product over its entire lifetime, with real-world accuracy. Armed with this data, generative design AI could then serially tweak the product design and simulate its lifetime performance under real-world conditions until it arrives at the best solution that satisfies the designer's goals.

With high-performance cloud computing, a wide range of goals can be optimized for with generative design. Depending on the product, part, or use case, the designer could use AI to optimize their part to extend lifetime, maintain strength, reduce weight, stay within a heat transfer threshold, or limit drag. Designs can also be optimized for different manufacturing techniques, enabling manufacturers to create designs that can be manufactured with the equipment they already have, whether it be casting, milling, or extrusion.

[<https://www.industryweek.com/technology-and-iiot/article/21130033/how-digital-twins-are-raising-the-stakes-on-product-development>]

# API (Application programming interface)

## Example:

Tampere traffic lights API  
Tampere City provides traffic light data interface.  
updated 20.12.2016

### Basic Information

- Data format: REST/JSON  
Standard: Traffic volume only [Datex2](#)  
Availability: Available  
Maintainance: Tampere  
City/Dynniq/Infotripla Oy  
Licence: Tampere City Open Data  
License/ITS Factory

### Data scope

- Tampere City street network

### Data contents

- Traffic volume, queue, wait time,

### Access constraints

- Use is free of charge.
- Distribution and re-use of the data is allowed.
- only server to server access is allowed

### API access

- [User documentation](#)

### Meta Data files

- [trafficVolume.csv](#)
- [congestion.csv](#)
- [waitTime.csv](#)
- [Interserction images \(folder\)](#)
- [Tampere Traffic Lights Geodata](#)

### More information

- Help and support:

[http://wiki.itsfactory.fi/index.php/Tampere\\_traffic\\_lights\\_API](http://wiki.itsfactory.fi/index.php/Tampere_traffic_lights_API)

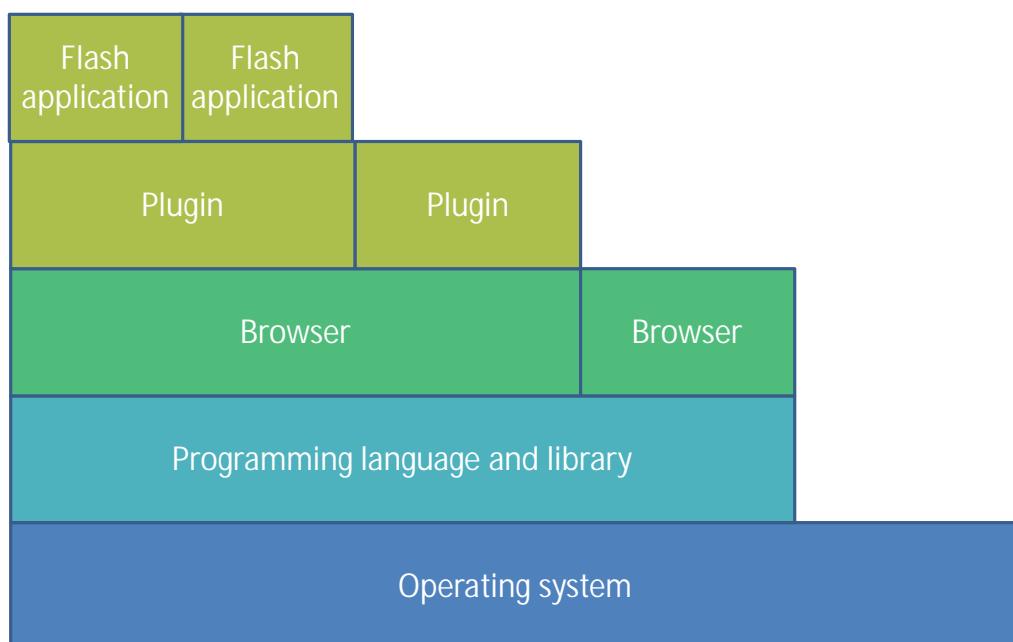
# API (Application programming interface)

```

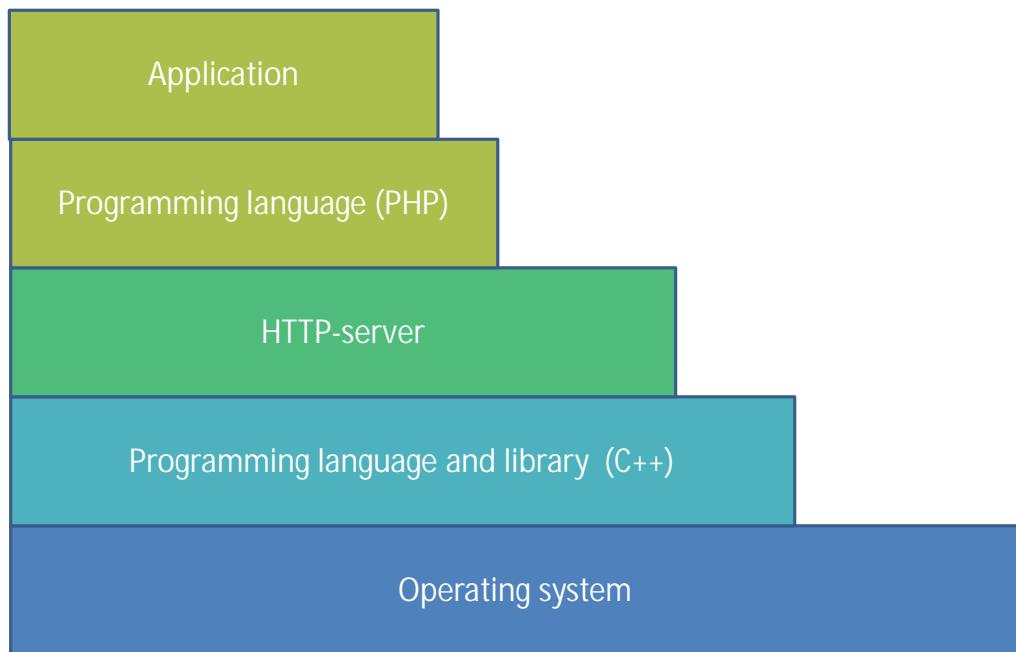
JSON Raw Data Headers
Save Copy Filter JSON
{
  "help": "https://data.tampere.fi/data/api/3/action/help_show?name=resource_show",
  "success": true,
  "result": {
    "cache_last_updated": null,
    "package_id": "a1638149-b2eb-4378-b259-de6d9c48774b",
    "position_info": "",
    "file_size": "",
    "time_series_precision-fi": "",
    "datastore_active": false,
    "time_series_precision": {},
    "size": null,
    "id": "5568ba48-d083-464a-be5f-335842f8fa49",
    "state": "active",
    "archiver": {
      "is_broken_printable": "Downloaded OK",
      "updated": "2019-11-19T02:15:47.591715",
      "cache_filepath": "/opt/databatalog/resource_cache/55/5568ba48-d083-464a-be5f-335842f8fa49/resource",
      "last_success": "2019-11-19T02:15:47.591715",
      "size": 12906,
      "is_broken": false,
      "failure_count": 0
    }
  }
}

```

## APIs at business enablers



# Server side could be like this



18.11.2020

TUNI \* COMPSE.100-EN Introduction to Sw Eng

109

 Tesla API

Model S API TMC Thread    Tesla Referral Code

Search...

**Tesla API**

**How is this site organized?**

This site is broken into sections for different API information:

- Authentication - API commands to generate an `{access_token}` to communicate with your vehicle.
- Vehicles - API commands to communicate between your vehicle and your client.
- Codes - Localized Tesla vehicle option codes for the [Model S](#) and [Model X](#)

**What Tesla products are supported?**

- Tesla Model S
- Tesla Model X
- Tesla Model 3

 Powered by GitBook

[\[https://www.teslaapi.io/\]](https://www.teslaapi.io/)

18.11.2020

TUNI \* COMPSE.100-EN Introduction to Sw Eng

110

<https://op-developer.fi/>



PSD2 Articles Docs Developers

Login

## Our APIs go beyond banking

Find new business opportunities and improve customer experience with OP's best-in-class APIs.

[Register now](#)

Create services in diverse fields

18.11.2020

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

111

[<https://www.programmableweb.com/category>]



[API DIRECTORY](#) ▾ [API NEWS](#) ▾

WRITE FOR US | BECOME MEMBER | LOGIN

Search over 23,803 APIs and much more

[LEARN ABOUT APIs](#)

[WHAT IS AN API ?](#)

[TUTORIALS](#)

[API CHARTS & RESEARCH](#)

[CORONAVIRUS](#)

[ADD APIs & MORE](#) ▾



## Search the Largest API Directory on the Web

Search Over 23,803 APIs

[SEARCH APIs](#)

Filter APIs

[Coronavirus](#) [COVID-19](#) ▾

Include Deprecated APIs

[API Name](#)

[Description](#)

[Category](#)

[Followers](#)

[Versions](#)

[Sonde Health API](#)

The Sonde Platform Service API includes the Sonde Health Check API which measure the level of wellness/health in a given voice sample. A Respiratory Symptoms Risk score is returned from a voice input...

[COVID-19](#)

0

[REST v1](#)

[Canada Open Covid API](#)

Canada Open Covid API provides data about the Coronavirus/COVID19 virus in the nation of Canada. Data returned includes active cases, cumulative cases, recovered, deaths, province, and testing...

[COVID-19](#)

6

[REST v1](#)

### Coronavirus Developer Resource Center

COVID-19 APIs, SDKs, coverage, open source code and other related dev resources »

### Today in APIs

Latest news about the API economy and newest APIs, delivered daily:

Email Address

[SUBSCRIBE](#)

### API UNIVERSITY

[FEATURED](#) [LATEST](#)

#### FOR API PROVIDERS

What Are APIs and How Do They Work?  
Guide to GraphQL: Understanding, Building and Using GraphQL APIs

# IPR, Intellectual property rights

## IP (FI: aineeton omaisuus)

IP = Intellectual Property

- copyright = FI: tekijänoikeudet
- patents = FI: patentti
- trademarks = FI: tavaramerkki
- industrial designs = FI: teollinen muotoilu
- geographical indications = FI: maantieteellinen sijainti.

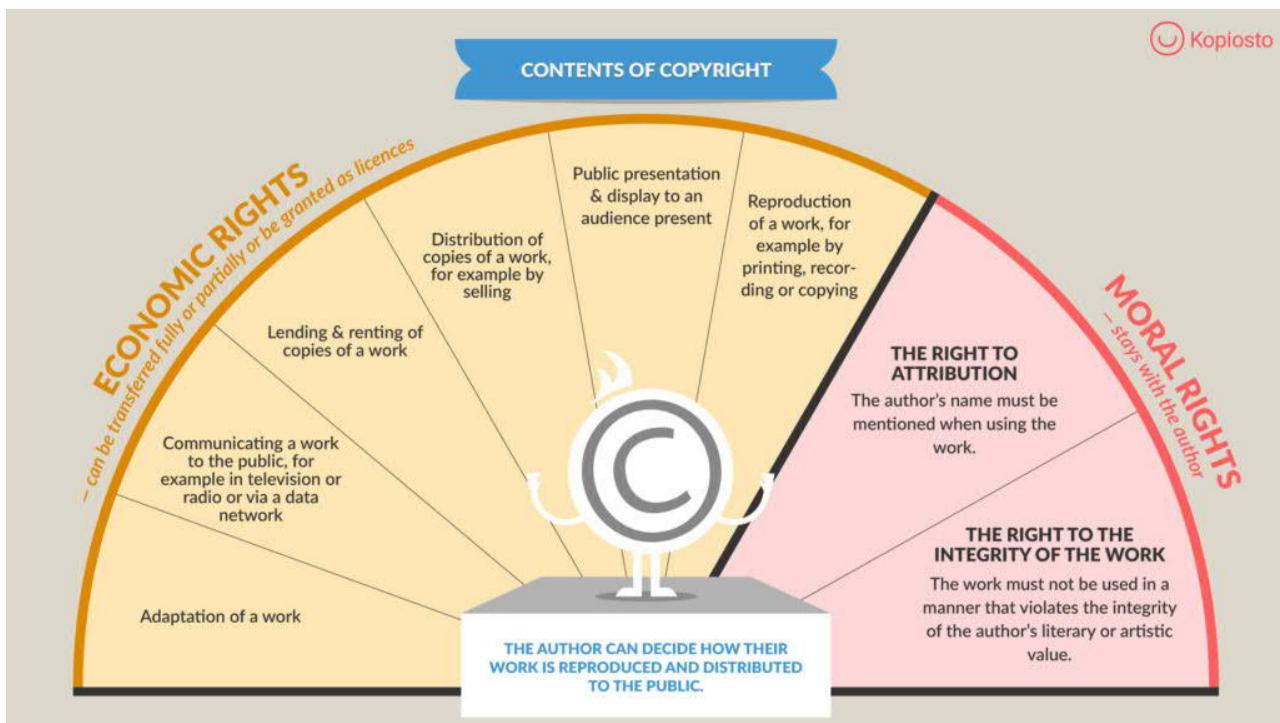
IPR = Intellectual Property Rights.

# IPR

Software, or computer programs, is a complex asset. At the boundary between pure creations of the mind and technical inventions, multiple **Intellectual Property Rights** (IPR) can protect it. The intangible nature, diversity of uses, and the various related means available in order to create value with software also has an impact on such a complexity.

**Intellectual Property** (IP) is an essential tool to secure value generated by software.

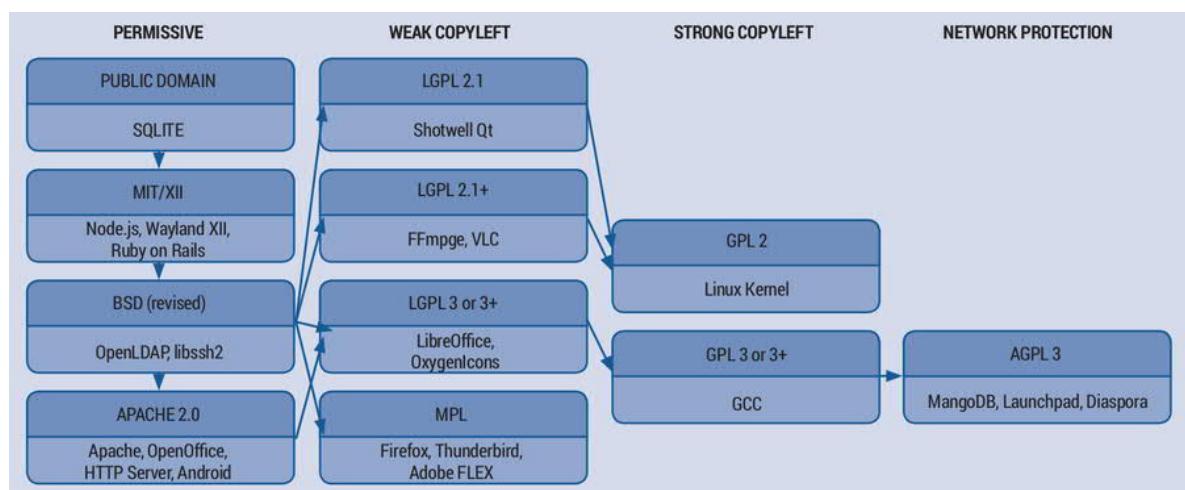
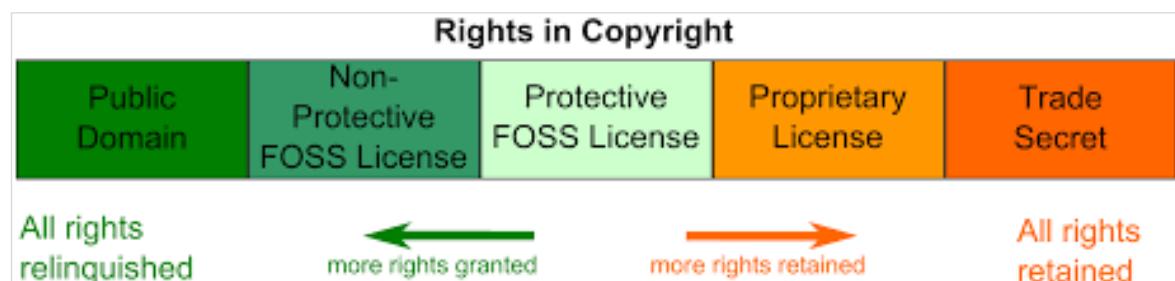
Types of IPR	Registration required	Software components
<b>Copyright</b>	No, as protection is automatic, but complementary solutions are available such as i-DEPOT or public forges <sup>1</sup> in order to further secure rights. In some countries registration is available and can fulfil essential purposes.	All the creative dimensions embedded in software are protected by copyright, provided they are original. Copyright is the historical and most frequently used means of protecting software. Copyrights protect the code as such, but also the user guides and the graphical elements such as icons.
<b>Patent</b>	Yes, under certain conditions <sup>2</sup>	Patents are meant to protect the functional dimension of software, by providing potential ownership of new and inventive technical effects implemented by the program.
<b>Trade marks</b>	It is highly advisable to seek registration.	Protects an essential aspect of software, be it of a visual or textual nature (via either a logo or a word). A trade mark is an essential protection in order to differentiate assets on a given market.
<b>Industrial Design</b>	Registration is generally recommended, even though unregistered designs can be protected	Protects the graphical user interfaces under certain requirements.
<b>Database rights</b>	No	The outputs of the software process can be protected by <i> sui generis</i> database protection.
<b>Confidential Information (trade secrets)</b>	No	Specific and identified information can be protected through contractual arrangements.



18.11.2020

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

117



## WIPO ([www.wipo.int](http://www.wipo.int))

WIPO = World Intellectual Property Organization

- WIPO is the global forum for intellectual property services, policy, information and cooperation. We are a self-funding agency of the United Nations, with 191 member states.
- Our mission is to lead the development of a balanced and effective international intellectual property (IP) system that enables innovation and creativity for the benefit of all.

## WIPO tips for sw patenting

Modern society relies heavily on computer technology. Without software, a computer cannot operate. Software and hardware work in tandem in today's information society. So it is no wonder that intellectual property protection of software is crucial not only for the software industry, but for other businesses as well.

The intellectual property protection of computer software has been highly debated at the national and international level.

TIP 1: Do you really need a patent for your software-related invention? Think twice before preparing a patent application.

TIP 2: What do you wish to protect from your competitors? Identify the core part of your innovation.

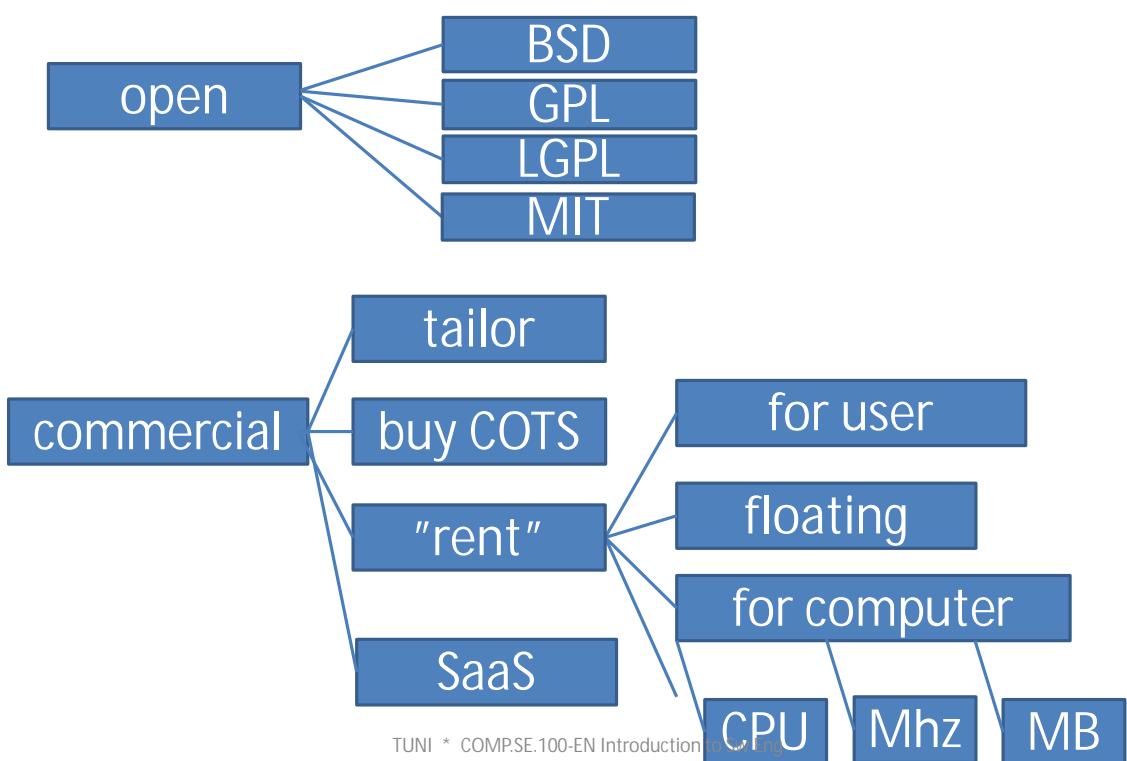
TIP 3: Is your innovation patentable? Not all types of software-related innovation can enjoy patent protection.

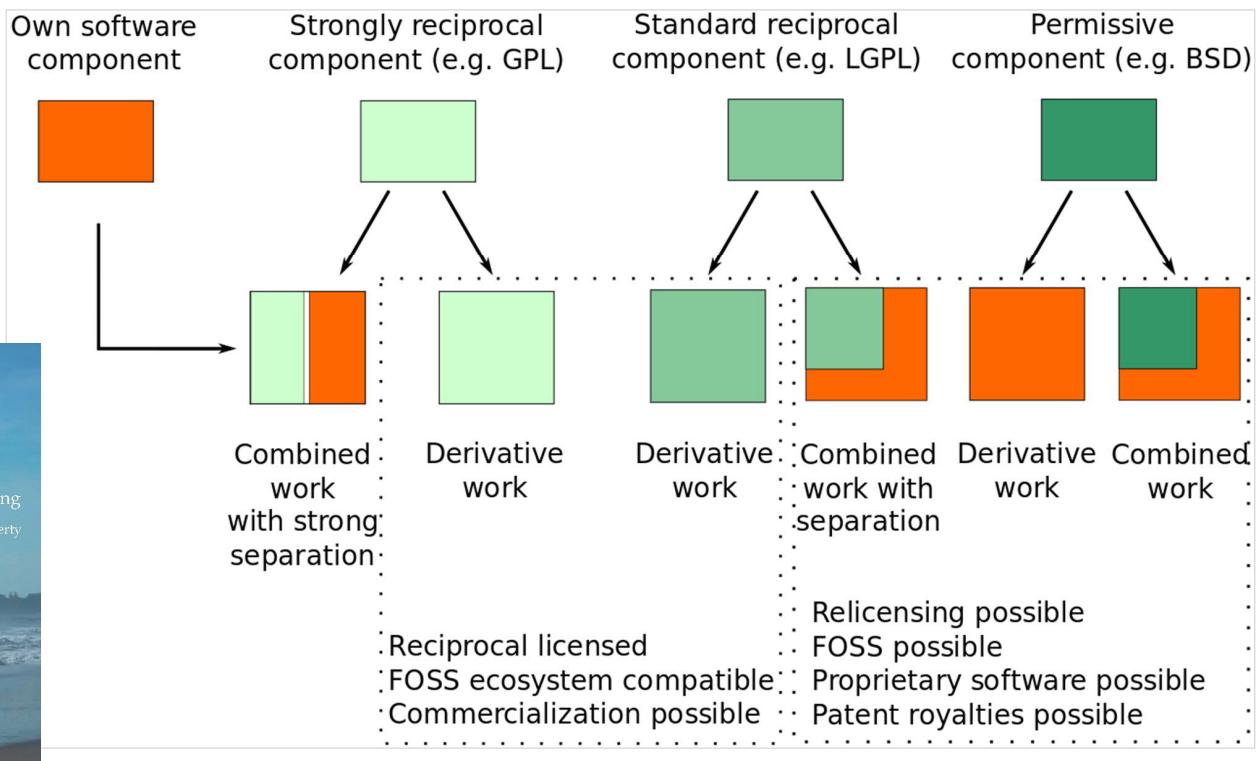
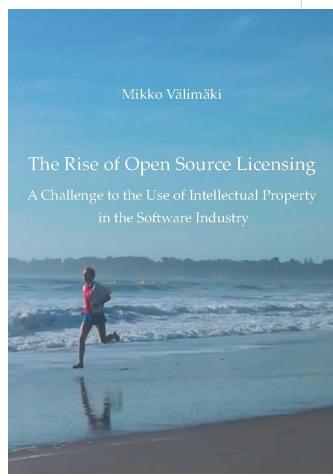
TIP 4: Do you need to protect your innovation abroad? Patentability requirements are not always the same in each country.

TIP 5: Consult an intellectual property expert who is familiar with the relevant national law and practice.

# Licenses

## Software licenses, one viewpoint





## EUPL European Union public license

### What is the EUPL?

EUPL is an acronym for "European Union Public Licence".

The first EUPL draft (v.0.1) went public in June 2005. A public debate was then organised by the European Commission (IDABC). The consultation of the developers and users community was very productive and has lead to many improvements of the draft licence; 10 out of 15 articles were modified. Based on the results of these modifications (a detailed report and the draft EUPL v.0.2), the European Commission elaborated a final version (v.1.0) that was officially approved on 9 January 2007, in three linguistic versions.

### EUPL version 1.2 (2017)

#### New version of open source licence EUPL available



The European Commission has released a new version of the European Union Public Licence (EUPL), a tool for publishing any copyrighted work as open source. The licence is legally consistent with the copyright law of all EU countries and is especially well-suited for public administrations

sharing IT solutions.

Compared to the previous versions, the updated EUPL v.1.2 has

##### 1. broader coverage:

In addition to software, the new version also covers data, documents, technical specifications and standards, as well as software source codes.

##### 2. wider compatibility:

## licenses

### Licenses that are "popular and widely-used or with strong communities"

The below list is based on publicly available statistics.

- Apache License 2.0 (Apache-2.0)
- 3-clause BSD license (BSD-3-Clause)
- 2-clause BSD license (BSD-2-Clause)
- GNU General Public License (GPL)
- GNU Lesser General Public License (LGPL)
- MIT license (MIT)
- Mozilla Public License 2.0 (MPL-2.0)
- Common Development and Distribution License 1.0 (CDDL-1.0)
- Eclipse Public License 2.0 (EPL-2.0).

Also e.g.:

- European Union Public License (EUPL-1.2).

## What is Copyleft

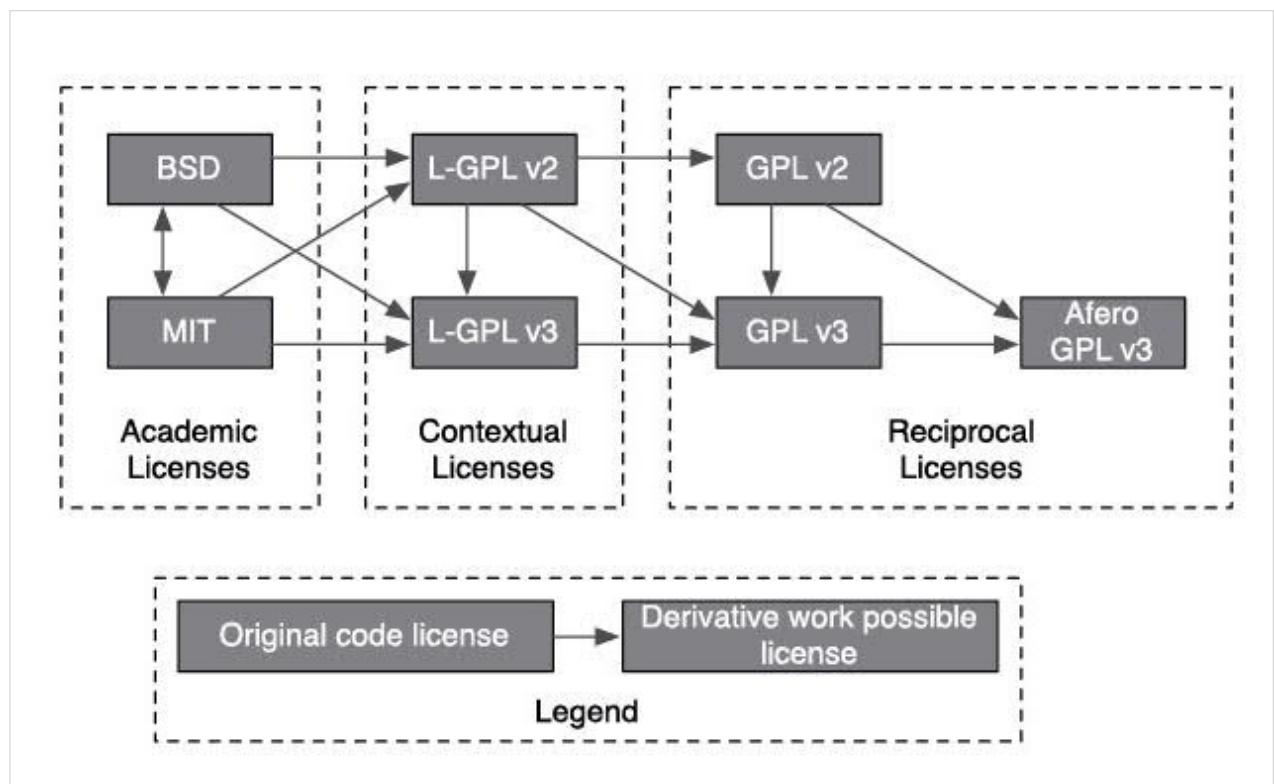
- Copyleft is a general method for making a program (or other work) free (in the sense of freedom, not "zero price"), and requiring all modified and extended versions of the program to be free as well.
- The simplest way to make a program free software is to put it in the public domain, uncopyrighted. This allows people to share the program and their improvements, if they are so minded. But it also allows uncooperative people to convert the program into proprietary software. They can make changes, many or few, and distribute the result as a proprietary product. People who receive the program in that modified form do not have the freedom that the original author gave them; the middleman has stripped it away.

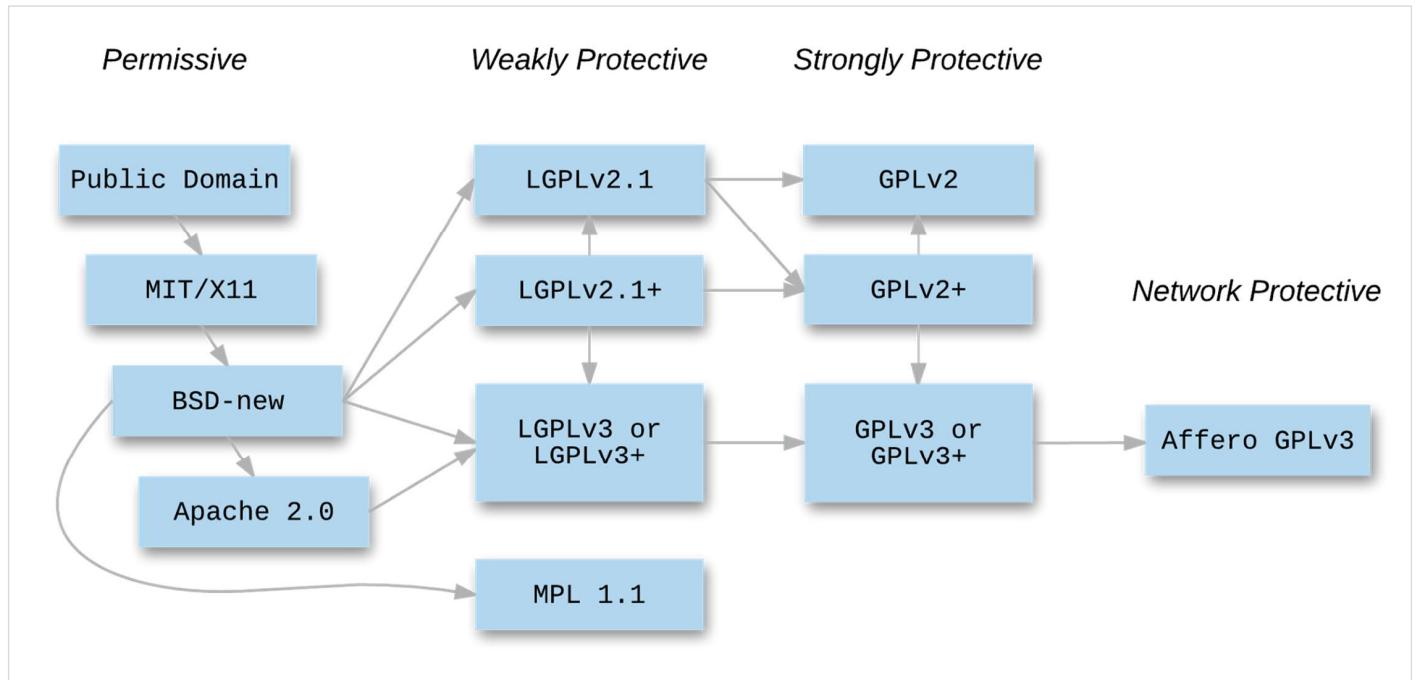
We classify a license according to certain key criteria:

- Whether it qualifies as a free software license.
- Whether it is a copyleft license.
- Whether it is compatible with the GNU GPL. Unless otherwise specified, compatible licenses are compatible with both GPLv2 and GPLv3.
- Whether it causes any particular practical problems.

Richard Stallman: When we call software “free,” we mean that it respects the users’ essential freedoms: the freedom to run it, to study and change it, and to redistribute copies with or without changes. This is a matter of freedom, not price, so think of “free speech,” not “free beer.”

Copyleft is a general method for making a program (or other work) free (in the sense of freedom, not “zero price”), and requiring all modified and extended versions of the program to be free as well.





[<https://medium.com/shakuro/software-licenses-explained-77f4f18ebef1>]

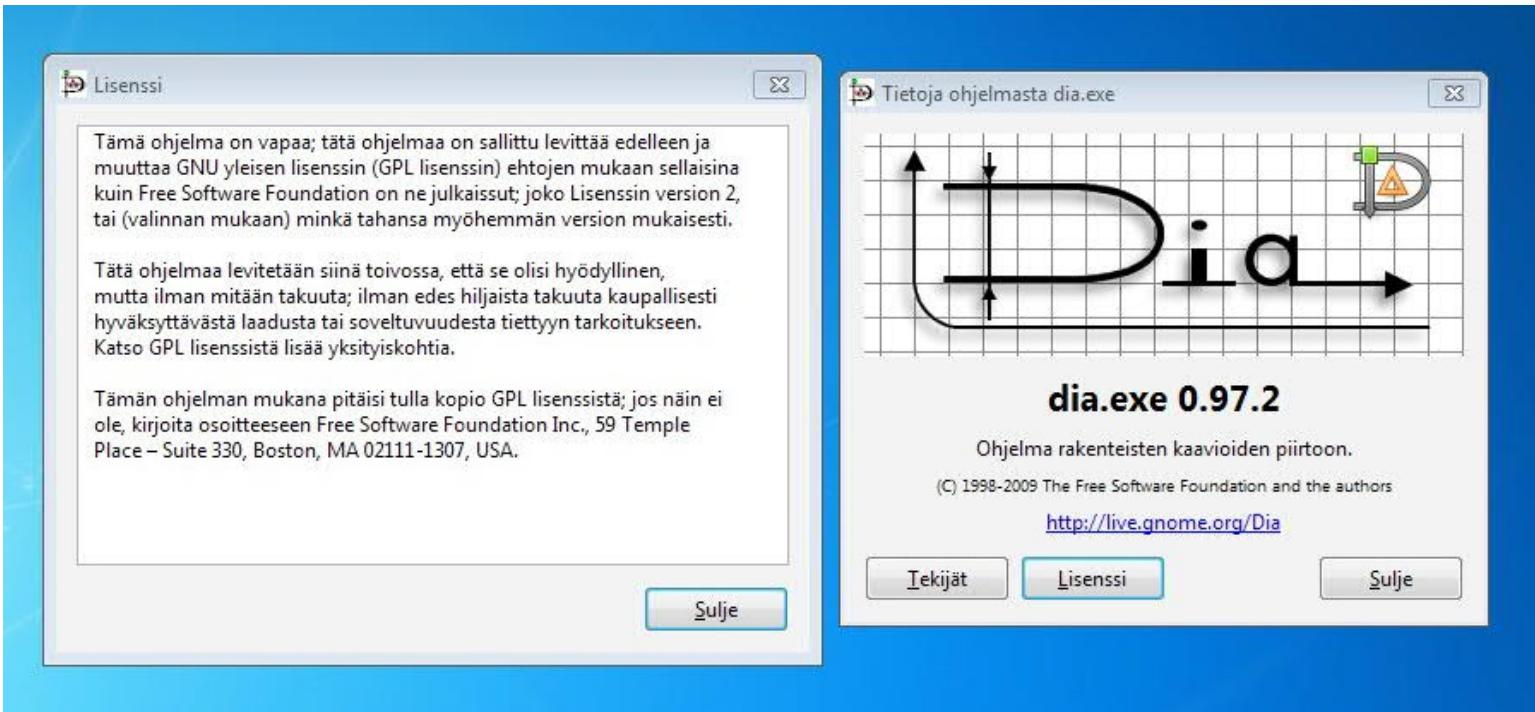
## EULA

### End User Licensing Agreements

The term “EULA” has multiple connotations for commercial software. Other names include: Purchaser Use Rights, Software License Agreement, and Software User Rights Agreement and there can be others as well.

EULAs include key clauses and general provisions. Key clauses include:

- license grant
- pricing
- warranty
- maintenance.

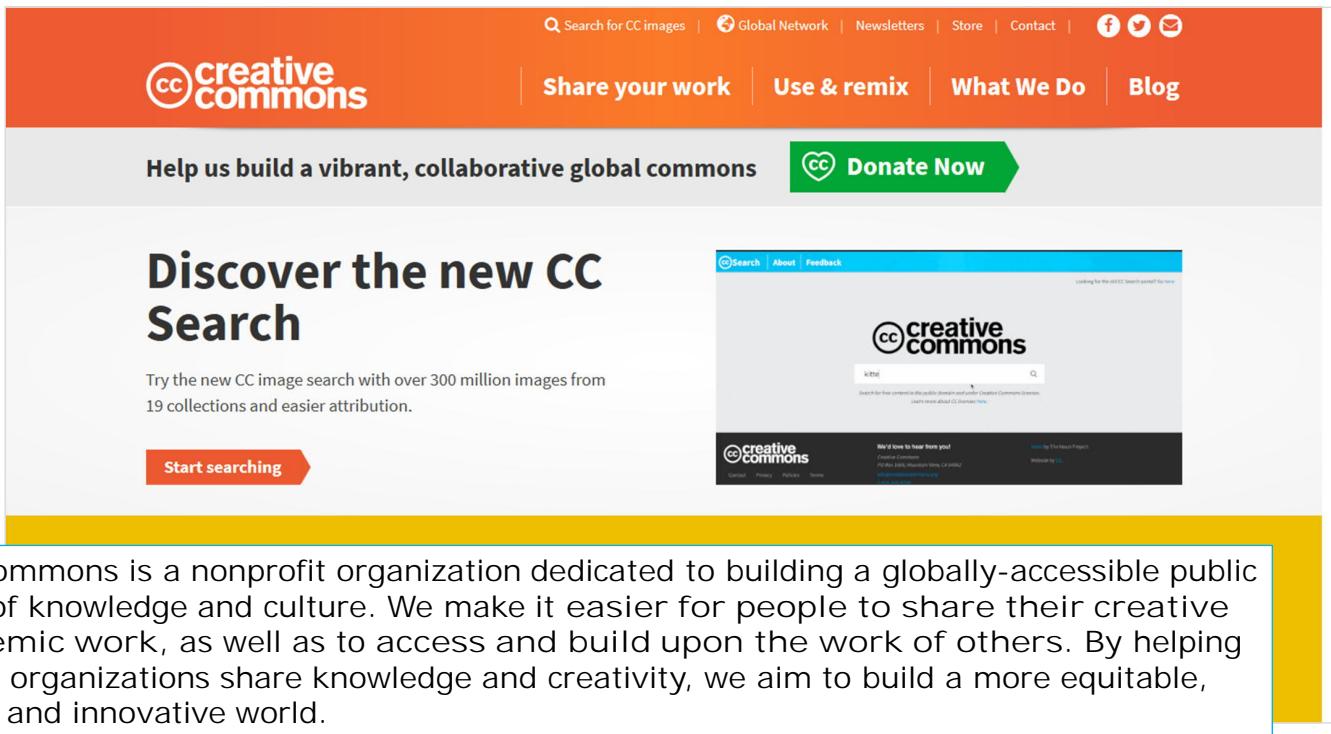


## another viewpoint

### Examples of software licenses

- Single-user license - The software is licensed for a single user and often a single computer.
- Multi-user license - This license allows you to install a program onto multiple computers used by multiple users. Typically this may be a set number of users. For example, a five user multi-user license allows up to five people to use the program.
- Site license - A program can be installed on an unlimited amount of computers, as long as they're at the location of the site license. Site licenses are usually for schools and businesses.
- Site licenses may be "floating licenses", e.g. at most 20 parallel users at a time.
- University "academic licenses" are usually just cheap price licenses.

<https://creativecommons.org/>



The screenshot shows the Creative Commons homepage with an orange header bar. The header includes the Creative Commons logo, search bar, and links for Global Network, Newsletters, Store, Contact, and social media. Below the header are navigation links for Share your work, Use & remix, What We Do, and Blog. A call-to-action button "Help us build a vibrant, collaborative global commons" and a "Donate Now" button are also present. The main content area features a large heading "Discover the new CC Search" and a sub-section about the new image search. A "Start searching" button is visible. To the right, there's a preview of the new CC search interface.

Help us build a vibrant, collaborative global commons [Share your work](#) [Use & remix](#) [What We Do](#) [Blog](#) [Donate Now](#)

## Discover the new CC Search

Try the new CC image search with over 300 million images from 19 collections and easier attribution.

[Start searching](#)



The preview shows the search interface with a search bar, navigation links (Search, About, Feedback), and a results page for a search term like "kitten". It includes filters for license type (CC0, CC BY, CC BY-NC, CC BY-ND) and a sidebar with information about Creative Commons and the CC0 license.

Creative Commons is a nonprofit organization dedicated to building a globally-accessible public commons of knowledge and culture. We make it easier for people to share their creative and academic work, as well as to access and build upon the work of others. By helping people and organizations share knowledge and creativity, we aim to build a more equitable, accessible, and innovative world.

## licenses

### Licenses that are "popular and widely-used or with strong communities"

The below list is based on publicly available statistics.

- Apache License 2.0 (Apache-2.0)
- 3-clause BSD license (BSD-3-Clause)
- 2-clause BSD license (BSD-2-Clause)
- GNU General Public License (GPL)
- GNU Lesser General Public License (LGPL)
- MIT license (MIT)
- Mozilla Public License 2.0 (MPL-2.0)
- Common Development and Distribution License 1.0 (CDDL-1.0)
- Eclipse Public License 2.0 (EPL-2.0).

Also e.g.:

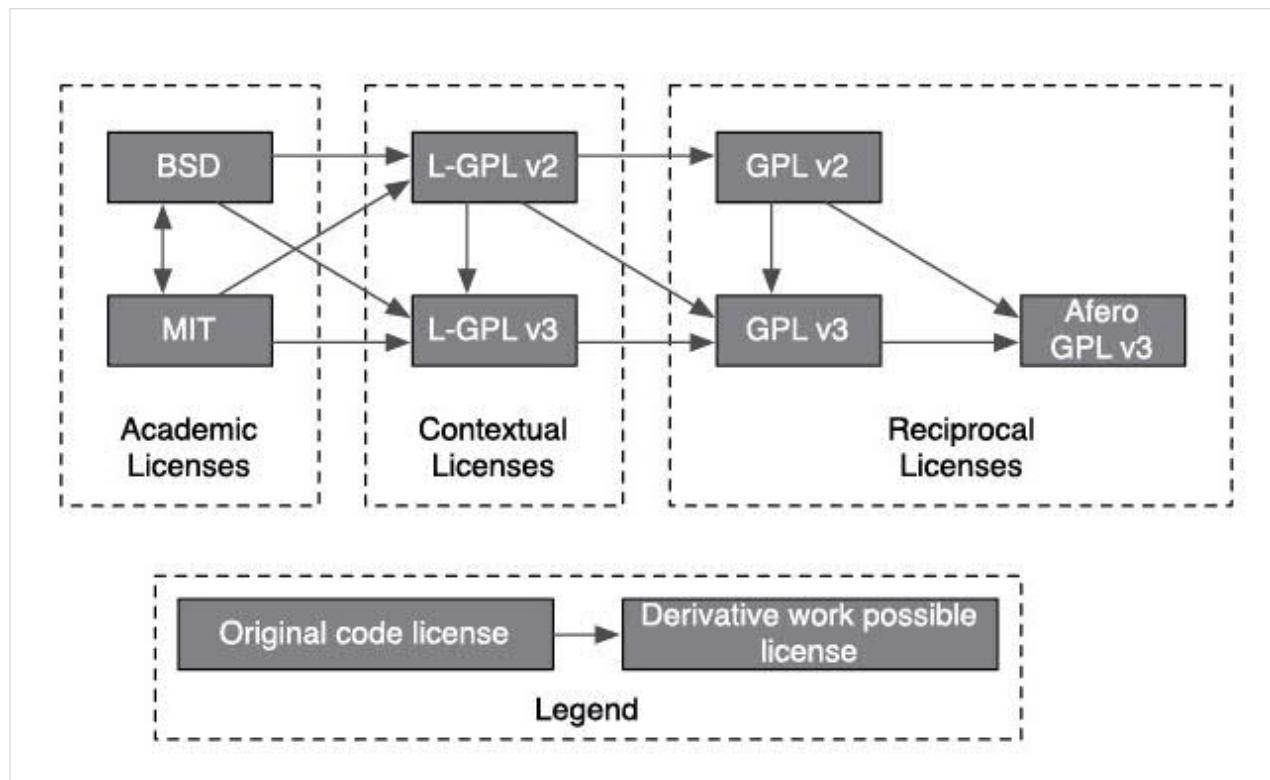
- European Union Public License (EUPL-1.2).

We classify a license according to certain key criteria:

- Whether it qualifies as a free software license.
- Whether it is a copyleft license.
- Whether it is compatible with the GNU GPL. Unless otherwise specified, compatible licenses are compatible with both GPLv2 and GPLv3.
- Whether it causes any particular practical problems.

Richard Stallman: When we call software "free," we mean that it respects the users' essential freedoms: the freedom to run it, to study and change it, and to redistribute copies with or without changes. This is a matter of freedom, not price, so think of "free speech," not "free beer."

Copyleft is a general method for making a program (or other work) free (in the sense of freedom, not "zero price"), and requiring all modified and extended versions of the program to be free as well.



# patents

## software patents

The European Commission issued finally in 2002 a draft proposal for a directive on patentability of computer-implemented inventions.

The directive aimed at harmonizing the various national practices regarding patenting of computer programs, which had developed under the EPO practice throughout the years. The concern was that rules regarding patentability of computer-implemented inventions were ambiguous and lacked legal certainty.

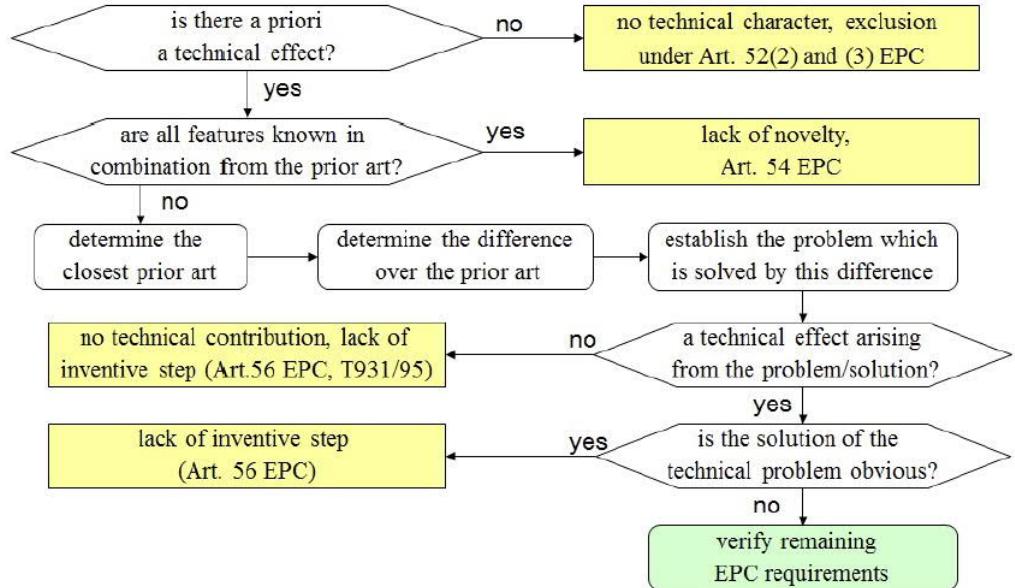
As to patenting of computer programs in Finland, the Patent Act of Finland provides that anyone who has made an invention susceptible of industrial application is entitled to an exclusive right to exploit the invention commercially. However, **software programs as such are not considered inventions within the meaning of §1 of the Finnish Patent Act**. Computer program alone may not be patentable, but as part as of, for example, a device also program may be within the patent eligible subject matter if the other preconditions for patentability are met. The restriction in the Patent Act of Finland regarding patentability of computer programs is based on the EPC under which software programs are not eligible for patent protection as such.



Anna Haapanen

FREE AND OPEN SOURCE  
SOFTWARE LICENSING  
AND THE MYSTERY OF LICENSOR'S PATENTS

## EPO and CII



### G. Herreman, Patentability of Computer-Implemented Inventions, European Patent Office (Discussion Workshop on Understanding the CII Directive 2005) at slide 24

## EPO Index for Computer-Implemented Inventions, 2019

A computer-implemented invention (CII) is one which involves the use of a computer, computer network or other programmable apparatus, **where one or more features are realised wholly or partly by means of a computer program.**

The following collection of hyperlinks is provided in order to facilitate access to the sections of the Guidelines for Examination in the EPO which give instructions particularly useful for the search and examination of CIIs.



#### URL

<https://www.epo.org/law-practice/legal-texts/html/guidelines/ej.htm>

#### Location

Home > Law & practice > Legal texts > Guidelines for Examination

## Guidelines for Examination

Index for Computer-Implemented Inventions

### Index for Computer-Implemented Inventions

A computer-implemented invention (CII) is one which involves the use of a computer, computer network or other programmable apparatus, where one or more features are realised wholly or partly by means of a computer program.

The following collection of hyperlinks is provided in order to facilitate access to the sections of the Guidelines for Examination in the EPO which give instructions particularly useful for the search and examination of CIIs.

It is noted that this collection is not a separate publication about CIIs. Instead, following a hyperlink will lead to the section of the most recent and applicable version of the Guidelines which has the stated number and title.



## Copyright vs. patent

Copyright law and patent law provide different types of protection. Copyright protection extends only to expressions, and not to ideas, procedures, methods of operation or mathematical concepts as such, whereas a patent is an exclusive right granted for an invention, which is a product or a process that provides a new way of doing something, or offers a new technical solution to a problem.

Copyright protection is formality-free in countries party to the Berne Convention for the Protection of Literary and Artistic Works (the Berne Convention), which means that protection does not depend on compliance with any formalities such as registration or deposit of copies.

A patent is generally granted after completing an examination procedure by a government agency. Copyright protection of computer software is established in most countries and harmonized by international treaties to that effect.

The law relating to the patentability of software is still not harmonized internationally, but some countries have embraced the patentability of computer software and others have adopted approaches that recognize inventions assisted by computer software.



Usually companies own employees' patents (related to work topics), by contract.

## Google wins six-year legal battle with Oracle over Android code copyright

The Guardian Thursday 26 May 2016 21.46 BST

Developers expected to welcome ruling that finds Google's employment of Java code in its Android operating system was fair use

Google has won a six-year court case brought by software firm Oracle, which claimed Google had infringed its copyright by using 11,500 lines of Java code in its Android operating system.

The jury ruled that Google's use of 37 Java APIs (application programming interfaces) was fair use. The news will be welcomed by developers, who typically rely on free access to APIs to develop third-party services.

Oracle had contested that Google's use of its proprietary Java code exceeded fair use, and was seeking damages of up to \$9bn.

# Contracts



European  
IP Helpdesk

## Your Guide to IP and Contracts



STAY AHEAD OF THE INNOVATION GAME

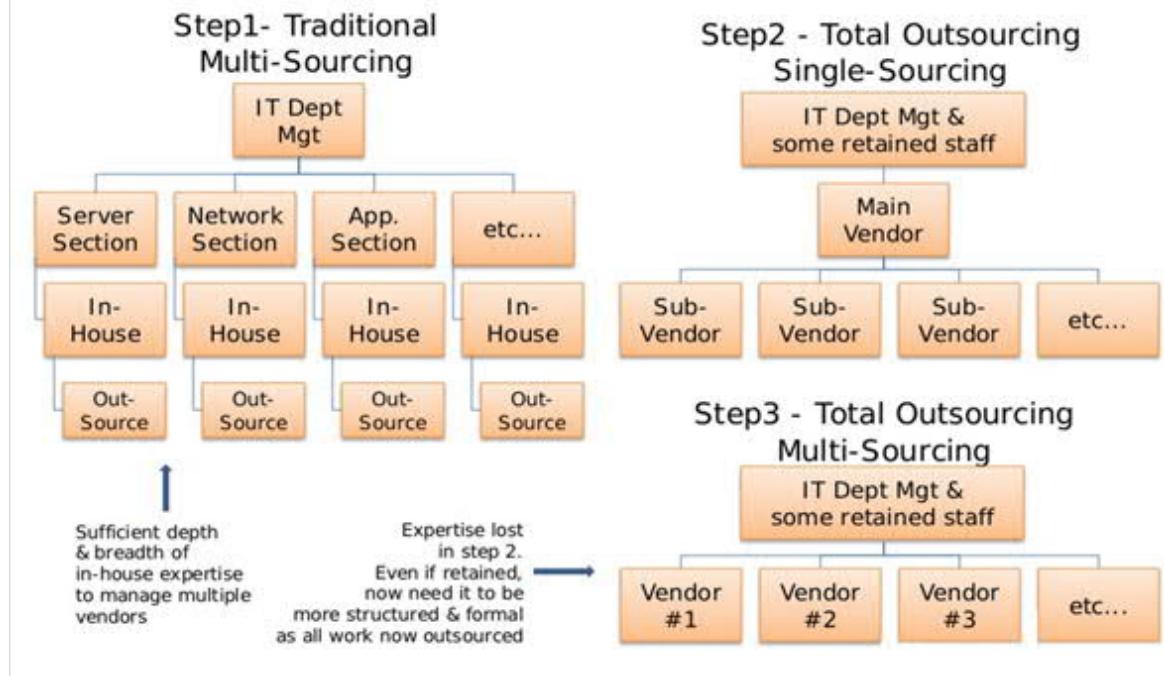


## Change in SIAM and IT Dept Structure

contracts

which option would be easier to manage ?

SIAM = service integration and management



IT2018 terms and conditions for ICT-projects

There are 9 contract model templates and 10 appendixes in English, too.

## Tutustu IT-ehtoihin

IT2018-ehdot sisältävät 10 sopimusehtoliitteitä ja 9 sopimusmallia. Alla olevista linkeistä voit esikatsella sopimusehtoliitteitä. Linkeistä voit myös ladata itsellesi word-muotoiset sopimusmallit, joita voit käyttää, kun sovellat IT2018-ehtoja liiketoiminnassasi.

### IT2018-Sopimusehtoliitteet (pdf), esikatseluversiot

IT2018 YSE - yleiset sopimusehdot  
IT2018 EAP - Erityisehtoja konsultointi- ja muista asianantijapalveluista  
IT2018 EHK - Erityisehtoja henkilötietojen käsittelystä  
IT2018 EJT - Erityisehtoja tietojärjestelmien ja asiakirjoitusten ohjelmistojen toimituksista  
IT2018 EKT - Erityisehtoja ohjelmistojen toimituksista ketterällä menetelmällä  
IT2018 ELH - Erityisehtoja laitteiden huoltopalveluista  
IT2018 ELT - Erityisehtoja laiteomittuksista  
IT2018 EOY - Erityisehtoja ohjelmistojen ylläpitopalveluista  
IT2018 ETP - Erityisehtoja tietoverkon välityksellä toimitettavista palveluista (pilvipalvelu)  
IT2018 EVT - Erityisehtoja valmisohjelmistojen toimituksista

### Ladattavat IT2018-sopimusmallit (docx)

Henkilötietojen käsittelysopimus IT2018

### Englanninkieliset IT2018-sopimusehtoliitteet (pdf), esikatseluversiot

IT2018 YSE - General terms and conditions  
IT2018 EAP - Special terms and conditions for consulting and other professional services  
IT2018 EHK - Special terms and conditions for the processing of personal data  
IT2018 EJT - Special terms and conditions for deliveries of data systems and customised software  
IT2018 EKT - Special terms and conditions for deliveries of software using agile methods  
IT2018 ELH - Special terms and conditions for equipment maintenance  
IT2018 ELT - Special terms and conditions for deliveries of equipment  
IT2018 EOY - Special terms and conditions for software maintenance  
IT2018 ETP - Special terms and conditions for services delivered via data network (cloud service)  
IT2018 EVT - Special terms and conditions for deliveries of standard software

IT2018 contract appendix English templates, preview versions

## Englanninkieliset IT2018-sopimusehtoliitteet (pdf), esikatseluversiot

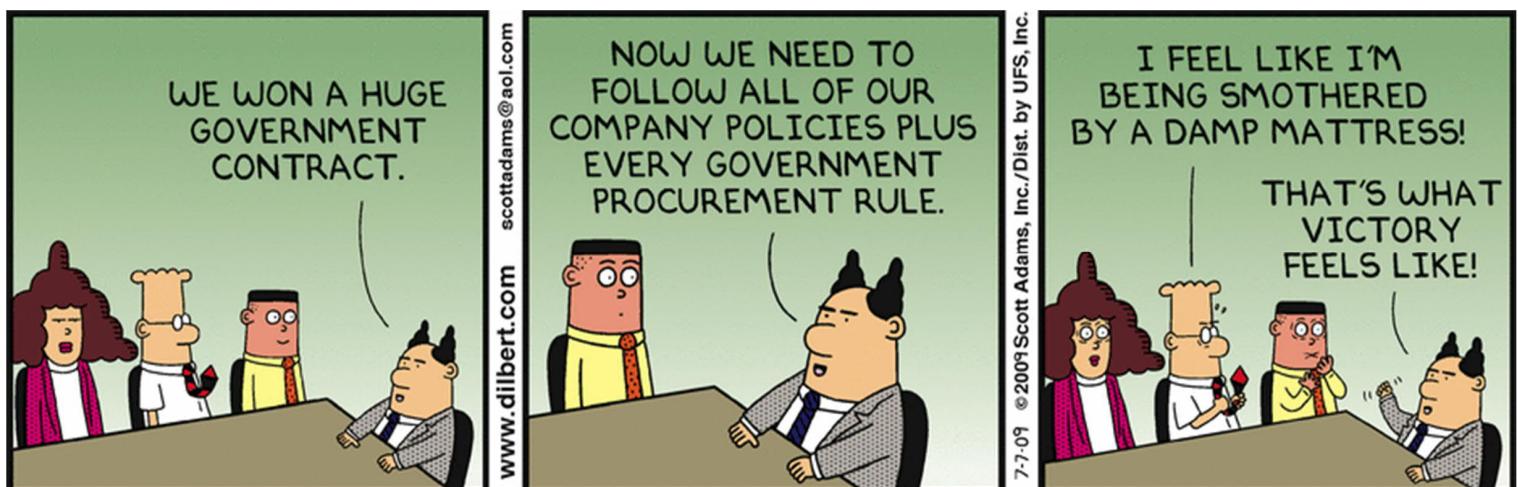
IT2018 YSE - General terms and conditions  
IT2018 EAP - Special terms and conditions for consulting and other professional services  
IT2018 EHK - Special terms and conditions for the processing of personal data  
IT2018 EJT - Special terms and conditions for deliveries of data systems and customised software  
IT2018 EKT - Special terms and conditions for deliveries of software using agile methods  
IT2018 ELH - Special terms and conditions for equipment maintenance  
IT2018 ELT - Special terms and conditions for deliveries of equipment  
IT2018 EOY - Special terms and conditions for software maintenance  
IT2018 ETP - Special terms and conditions for services delivered via data network (cloud service)  
IT2018 EVT - Special terms and conditions for deliveries of standard software

## Downloadable English contract templates

### Ladattavat englanninkieliset IT2018-sopimusmallit (docx)

Agreement for the processing of personal data IT2018  
Delivery agreement for software using agile methods IT2018  
Consulting and other professional services agreement IT2018  
Equipment maintenance agreement IT2018  
Software maintenance agreement IT2018  
Service level description on measuring usability of the service IT2018  
Non-disclosure agreement IT2018  
Agreement on services delivered via data network IT2018  
Delivery agreement IT2018

[<http://www.it-ehdot.fi/tutustu-ehtoihin>]



Sometimes an agreement may mean a lot of "extra" work...  
e.g. by heavy quality handbooks.

<https://www.contractstandards.com/public/contracts/software-development-agreement>

<https://ict-sopimukset.fi/> (commercial, English templates, by TIEKE [www.tieke.fi](http://www.tieke.fi))



INDEPENDENT

NEWS POLITICS VOICES FINAL SAY SPORT CULTURE VIDEO INDY/LIFE INDYBEST LONG READS INDY100 VOUCHERS

News > UK > Home News

# Amazon 1p glitch: Software error sees hundreds of items sold for fractions of their value

Retailers say they could be bankrupted by the fault in software that claims to 'auto-optimize' listings

Adam Withnall | @adamwithnall | Sunday 14 December 2014 14:05 | 32 comments

[Click to follow The Independent](#)

Friday 12.12.2014 at 17-18 local time, automatic algorithm "ran mad" and many products got the price of one (1) pence.

So, who is guilty, who pays the losses ? Developer ?

It is all about the contract...



18.11.2020

TUNI \* COMPSE.100-EN Introduction to Sw Eng

155



"Vendor lock", buying software from single source (who will not let anybody else see the source code, nor does open APIs for other companies).

18.11.2020

TUNI \* COMPSE.100-EN Introduction to Sw Eng

156



Always read and understand the contract text carefully.

## Non-competition agreement (FI: kilpailukieltosopimus)

# Non-competition agreements

A non-competition agreement is an agreement that restricts the employee's right to work for another company acting in the same field of business with his or her employer.

A non-competition agreement can also limit the employee's right to have his or her own competing business.

**A non-competition agreement can only be made if there is a weighty reason for its need**, arising from the employer's business or the employment relationship.

[www.tek.fi]

Recently there have been public discussion about how often such NCAs would actually be needed at all. In many cases those are done "just in case such would be needed", but employees should get a good compensation for NCA.

18.11.2020

TUNI \* COMPSE.100-EN Introduction to Sw Eng

159

The screenshot shows the TEK (Teknillisen Akatemian) website. The top navigation bar includes links for EN, MY.TEK.FI, and social media (Facebook, Twitter, LinkedIn). Below the navigation is a search bar and a keyword input field. The main menu has categories like TEK, MEMBERSHIP, SERVICES, and TECHNOLOGY = FUTURE. A sidebar on the left lists services: CAREER SERVICES, HELP IN CAREER TRANSITIONS, LEGAL CONSULTING (with sub-links for LEGAL DATA BANK and PROFESSIONAL LIABILITY AND LEGAL EXPENSES INSURANCE), SALARIES, WHERE ARE YOU IN YOUR CAREER?, WORKING LIFE IN FINLAND, and ENTREPRENEURS. The main content area features a large title 'COMPETING ACTIVITIES AND NON-COMPETITION AGREEMENTS' and a sub-section 'Information about non-competition agreements and competing activities.' A purple box on the right states 'student members of TEK can get e.g. legal advice'. At the bottom, there's a 'Share this page' button and a URL [https://www.tek.fi/en/services/legal-consulting/legal-data-bank/competing-activities-and-non-competition-agreements].

18.11.2020

TUNI \* COMPSE.100-EN Introduction to Sw Eng

160



18.11.2020

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

161

## Non-disclosure agreement (NDA) (FI: Salassapitosopimus)

# NDA (confidentiality agreement)

A non-disclosure agreement (NDA) is quite common in ICT industry.

It binds a recipient of secret information from releasing to a third (3rd) party or the general public.

Here secret means any information that is not available from public sources.

The secret information typically means trade or business secrets (e.g. processes, economical success, inventions) that an individual or company does not want to reveal to competitors.

[<http://iprhelpdesk.eu/news/european-ipr-helpdesk-publishes-templates-non-disclosure-agreements>]



European  
IP Helpdesk

Follow us: [in](#) [tw](#) [fb](#) [ri](#)

Login Subscribe

Services News Events Library Training Ambassadors Helpline Blog Contact



The European IPR Helpdesk publishes templates of non-disclosure agreements [News](#)



Search

## Upcoming events

Webinar: IP and Artificial Intelligence

**WEDNESDAY, 18.11.2020**

Webinar on the New Copyright Directive

**THURSDAY, 19.11.2020**

Webinar: Impact and Innovation in Horizon 2020 – a Guide for Proposers

**TUESDAY, 24.11.2020**

[See all events](#)

## Latest news [All](#)

## European IPR Helpdesk



### *Non-Disclosure Agreement (Template)*

#### Disclaimer

This sample document has been produced by the European IPR Helpdesk, based on the experiences and acknowledgements gathered during the performance of its activities, including the Helpline support service, awareness raising activities and feedback from users on publications. The European IPR Helpdesk is managed by the European Commission's Executive Agency for Small and Medium-sized Enterprises (EASME), with policy guidance provided by the European Commission's Enterprise and Industry Directorate – General. Even though the contents of this document have been provided with the financial support of the EU, the positions expressed are those of the authors and do not necessarily reflect the official opinion of EASME or the European Commission. Please see our full disclaimer at:  
<http://www.iprhelpdesk.eu/disclaimer>

This document is intended to be or to provide initial guidance and should be tailored to meet your specific requirements. It should not be construed as legal advice for any particular facts or circumstances.

Although the European IPR Helpdesk endeavours to deliver a high quality service, no guarantee can be given on the correctness or completeness of the content of this document and neither the European Commission, nor EASME nor the European IPR Helpdesk consortium members are responsible or may be held accountable for any loss suffered as a result of reliance upon the content of this work.

© European Union 2014

## European IPR Helpdesk



### *Mutual Non-Disclosure Agreement (Template)*

#### Disclaimer

This sample document has been produced by the European IPR Helpdesk, based on the experiences and acknowledgements gathered during the performance of its activities, including the Helpline support service, awareness raising activities and feedback from users on publications. The European IPR Helpdesk is managed by the European Commission's Executive Agency for Small and Medium-sized Enterprises (EASME), with policy guidance provided by the European Commission's Enterprise and Industry Directorate – General. Even though the contents of this document have been provided with the financial support of the EU, the positions expressed are those of the authors and do not necessarily reflect the official opinion of EASME or the European Commission. Please see our full disclaimer at:  
<http://www.iprhelpdesk.eu/disclaimer>

This document is intended to be or to provide initial guidance and should be tailored to meet your specific requirements. It should not be construed as legal advice for any particular facts or circumstances.

Although the European IPR Helpdesk endeavours to deliver a high quality service, no guarantee can be given on the correctness or completeness of the content of this document and neither the European Commission, nor EASME nor the European IPR Helpdesk consortium members are responsible or may be held accountable for any loss suffered as a result of reliance upon the content of this work.

© European Union 2014

## One example NDA

[<https://www.keksintosaatio.fi/>]

KEKSINTÖSÄÄTIÖ	
<b>NON-DISCLOSURE AGREEMENT, unilateral</b>	
<p>This model non-disclosure agreement of the Foundation for Finnish Inventions is indicative only and intended to be used in situations where only one contracting party discloses confidential information. This model cannot take into account factors which in concrete situations affect the drafting of an individual agreement. The Foundation for Finnish Inventions or any persons acting on its behalf shall not be liable for this model or the consequences of the use of the information included therein.</p>	
<b>1. PARTIES</b>	
Disclosing Party: Contact person: Address: Domicile: Telephone: Fax:	Receiving Party: Contact person: Address: Domicile: Telephone: Fax:
<b>2. PURPOSE OF THE AGREEMENT</b>	
<p>The Disclosing Party possesses confidential information and material, which he is willing to disclose to the Receiving Party for the purposes of this agreement. The Disclosing Party wishes to keep secret the Confidential Information disclosed by him. The purpose of this agreement is to prevent the Receiving Party from disclosing or otherwise making available the Confidential Information disclosed by the Disclosing Party to a third party and from using the Confidential Information for purposes other than those specified in this agreement.</p>	
<b>3. DEFINITION OF CONFIDENTIAL INFORMATION AND PURPOSE OF DISCLOSURE</b>	
<p>"Confidential Information" shall mean any and all information disclosed by the Disclosing Party to the Receiving Party, including all documents, materials and other data (including but not limited to all technical, financial and commercial information, such as inventions, business secrets, strategies, data, samples, prototypes, drawings, designs/plans and specifications) regardless of the way or form in which the information is disclosed or how the Receiving Party otherwise received knowledge thereof.</p>	
<p><b>Confidential Information shall not, however, include information:</b></p> <ul style="list-style-type: none"> <li>a) which has been or subsequently becomes publicly known without breach of this agreement;</li> <li>b) which is proven to have been in the possession of the Receiving Party prior to the receipt of the information from the Disclosing Party and which the Receiving Party has not directly or indirectly obtained from the Disclosing Party;</li> <li>c) which the Receiving Party has received from a third party without any obligation of confidentiality;</li> <li>d) the disclosure and use of which the Disclosing Party has expressly approved in advance in writing;</li> <li>e) which, pursuant to mandatory law, regulation, court order, or a binding order of the authorities can be disclosed.</li> </ul>	

## NON-DISCLOSURE AGREEMENT (NDA)

This Nondisclosure Agreement or ("Agreement") has been entered into on the date of \_\_\_\_\_ and is by and between:

**Party Disclosing Information:** \_\_\_\_\_ with a mailing address of \_\_\_\_\_ ("Disclosing Party").

**Party Receiving Information:** \_\_\_\_\_ with a mailing address of \_\_\_\_\_ ("Receiving Party").

For the purpose of preventing the unauthorized disclosure of Confidential Information as defined below. The parties agree to enter into a confidential relationship concerning the disclosure of certain proprietary and confidential information ("Confidential Information").

**1. Definition of Confidential Information.** For purposes of this Agreement, "Confidential Information" shall include all information or material that has or could have commercial value or other utility in the business in which Disclosing Party is engaged. If Confidential Information is in written form, the Disclosing Party shall label or stamp the materials with the word "Confidential" or some similar warning. If Confidential Information is transmitted orally, the Disclosing Party shall promptly provide writing indicating that such oral communication constituted Confidential Information.

**2. Exclusions from Confidential Information.** Receiving Party's obligations under this Agreement do not extend to information that is: (a) publicly known at the time of disclosure or subsequently becomes publicly known through no fault of the Receiving Party; (b) discovered or created by the Receiving Party before disclosure by Disclosing Party; (c) learned by the Receiving Party through legitimate means other than from the Disclosing Party or Disclosing Party's representatives; or (d) disclosed by Receiving Party with Disclosing Party's prior written approval.

Think what agreements you sign



# GDPR

## GDPR = General Data Protection Regulation

The screenshot shows a web page from gdpr.eu. At the top, there's a navigation bar with links to Home, Checklist, FAQ, GDPR, and News & Updates. There are also social media links for Facebook and Twitter, and a search bar. The main content area has a blue background image of a hand holding a pen over a document. The title 'What is a GDPR data processing agreement?' is displayed prominently. Below the title, there's a section of text explaining the importance of data processing agreements. A sidebar on the right is titled 'Related articles' and lists three items: 'Data Processing Agreement (Template)', 'What is considered personal data under the EU GDPR?', and 'Writing a GDPR-compliant privacy notice (template included)'. Another sidebar at the bottom is titled 'Forms and Templates' and lists three items: 'Data Processing Agreement', 'Right to Erasure Request Form', and 'Privacy Policy'.

Rule of thumb: if you need to handle personal ID (social security number) in your application, you are in trouble.

Virtually every business relies on third parties to process personal data. Whether it's an email client, a cloud storage service, or website analytics software, you must have a data processing agreement with each of these services to achieve GDPR compliance.

This EU General Data Protection Regulation takes a more serious approach to contracts than previous EU data regulations did. If your organization is [subject to the GDPR](#), you must have a written data processing agreement in place with all your data processors. Yes, a data processing agreement is more annoying paperwork. But it's also one of the most basic steps of GDPR compliance and necessary to avoid GDPR fines.

This guide serves as an introduction to data processing agreements — what they are, why they're important, who they're for, and what they need to say. You can also follow the link to find a [GDPR data processing agreement template](#) that you can download, customize, and use for your company.

[<https://gdpr.eu/what-is-data-processing-agreement/>]

**EUR-Lex**  
Access to European Union lawEnglish  Guest  MENU QUICK SEARCH Search tipsNeed more search options? Use the [Advanced search](#)

EUROPA &gt; EUR-Lex home &gt; EUR-Lex - 32016R0679 - EN

## Document 32016R0679

 ?   Share

Text
<a href="#">Document information</a>
<a href="#">Procedure</a>
<a href="#">Document summary</a>
<input type="checkbox"/> <a href="#">Save to My items</a>
<input checked="" type="checkbox"/> <a href="#">Up-to-date link</a>
<input checked="" type="checkbox"/> <a href="#">Permanent link</a>
<input checked="" type="checkbox"/> <a href="#">Download notice</a>
<input checked="" type="checkbox"/> <a href="#">Follow this document</a>

 Table of contents

## Title and reference

 Expand all  Collapse all

Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) (Text with EEA relevance)

OJ L 119, 4.5.2016, p. 1–88 (BG, ES, CS, DA, DE, ET, EL, EN, FR, GA, HR, IT, LV, LT, HU, MT, NL, PL, PT, RO, SK, SL, FI, SV)

● In force: This act has been changed. Current consolidated version: [04/05/2016](#)

ELI: <http://data.europa.eu/eli/reg/2016/679/oj>

## Languages, formats and link to OJ

	BG	ES	CS	DA	DE	ET	EL	EN	FR	GA	HR	IT	LV	LT	HU	MT	NL	PL	PT	RO	SK	SL	FI	SV					
HTML																													
PDF																													
Official Journal																													

 Tampereen yliopisto  
Tampere University

4.5.2016

EN

Official Journal of the European Union

L 119/1

I

(Legislative acts)

## REGULATIONS

REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL  
of 27 April 2016on the protection of natural persons with regard to the processing of personal data and on the free  
movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 16 thereof,

Having regard to the proposal from the European Commission,

After transmission of the draft legislative act to the national parliaments,

Having regard to the opinion of the European Economic and Social Committee (¹),

Having regard to the opinion of the Committee of the Regions (²),

Acting in accordance with the ordinary legislative procedure (³),



GOOGLE ▾ POLICY ▾ US &amp; WORLD ▾

## Google fined €50 million for GDPR violation in France

The CNIL said Google's data consent policies aren't easily accessible or transparent

By Jon Porter | @JonPorty | Jan 21, 2019, 11:16am EST

f t SHARE

### France: Google fined €50 million (2019)

Back in January, the French Data Protection Authority (CNIL) fined Google €50 million for a lack of transparency, inadequate information and a lack of valid consent regarding the personalisation of adverts on its platform. The level of the CNIL's fine was determined by the "massive and intrusive" nature of Google's data processing, as well as the key nature of the relevant GDPR provisions.

## GDPR issues 2019

### Sweden: first fine issued to local school

On 20 August 2019 the Swedish DPA issued the country's first GDPR fine to a local high-school for its use of facial recognition technology. The authority held that the technology, which was used to monitor student attendance, was excessively intrusive, while the permission obtained from students did not constitute GDPR-required consent because it was not voluntarily given and freely chosen. What is more, the school had failed to conduct the necessary documented data protection impact assessment.

### United Kingdom: ICO announces biggest fines to date

To reinforce this point, the ICO released a second statement the following day, announcing that it would also be fining hospitality company Marriott International £99 million (approximately €110.4 million) for similar security failures. In this case, an ICO investigation revealed that the personal data of 30 million Marriott International guests – including their names, post and email addresses, phone numbers, passport numbers, dates of birth, genders and encrypted payment card numbers – had been compromised.

FOR PRIVATE PERSONS FOR ORGANISATIONS 

The Office of the Data Protection Ombudsman safeguards your  
rights and freedoms when processing personal data

If you would like to have your personal data transferred to another controller Jos joudut tietoturvaloukkuksen kohteeksi (in Finnish) If you do not want your data processed Jos sinulta häviää henkilötietoja (in Finnish) Have you been subjected to a decision based solely on automated processing? Frequently asked questions When a competent authority processes your data Notification to the Data Protection Ombudsman 

## Data Protection Policy

 Tampere University and TAMK

 Personnel + Student

### Contents

1. Coming into force
2. Purpose and goals
3. Scope
4. Definitions
5. Roles and responsibilities
6. Enforcement of data protection regulations
7. Protection of research data
8. Protection of student data
9. Information security
10. Duty to report personal data breaches
11. Training and instructions
12. Non-compliance
13. Coming into force

All the members of the university community (top management, employees, students and visitors) are obligated to adhere to this Data Protection Policy and all the other practices, regulations and instructions governing data protection and information security within the University.

## Data protection and information security briefly

 Tampere University and TAMK

 Personnel + Student

### Data protection

Data protection is the process of protecting personal data. Data protection is a fundamental right and safeguards the rights and freedoms of data subjects when their personal data is processed. Data processing laws set out the principles for the lawful processing of personal data. The processing of personal data must always be based on law.

Under the EU's General Data Protection Regulation (GDPR), the term 'personal data' is broadly defined as *all information relating to an identified or identifiable natural person*. Natural persons are considered identifiable, if they can be identified, *directly or indirectly*, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier, an opinion, a job title, image or audio, or one or more factors specific to their physical, physiological, genetic, mental, economic, cultural or social identity.

The GDPR imposes heightened requirements on processing activities and personal data that by their nature involve a high risk to the rights and freedoms of data subjects. At the University, data is classified into one of four sensitivity levels.

### Information security

Information security plays a key role in enforcing data protection. It means protecting data and information systems from unauthorised access. Among other things, the term refers to the technical and organisational measures taken to ensure the confidentiality and integrity of data, the usability of systems and the enforcement of data subjects' rights.

# Legal matters

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

18.11.2020 179

[\[https://arbitration.fi/arbitration/costs-of-arbitration/calculator-2017/\]](https://arbitration.fi/arbitration/costs-of-arbitration/calculator-2017/)



The Finland Arbitration Institute (FAI) is part of the Finland Chamber of Commerce. The website features a green header with the FAI logo, a marina photograph, and language links (EN, FI, SV, ES). The main menu includes ARBITRATION, MEDIATION, THE ARBITRATION INSTITUTE, NEWS, EVENTS, and FAI CASES. A sidebar on the left lists links for THE FAI ARBITRATION PROCESS, ARBITRATION RULES, GUIDELINES AND INSTRUCTIONS, MODEL ARBITRATION CLAUSES, HOW TO INITIATE AN ARBITRATION, COSTS OF ARBITRATION, and FILING FEE. The central content area displays a calculator for arbitration fees starting from June 2017, with a note about currency conversion. A 'Quick links' section includes a search bar.

**THE FINLAND ARBITRATION INSTITUTE**  
PART OF THE FINLAND CHAMBER OF COMMERCE

ARBITRATION MEDIATION THE ARBITRATION INSTITUTE NEWS EVENTS FAI CASES

EN FI SV ES

CONTACT US FAI NEWSLETTER YACF

THE FAI ARBITRATION PROCESS

Calculator (Requests for Arbitration filed on or after 1 June 2017)

The calculator is applicable to arbitrations, where the Request for Arbitration has been filed with the Institute on or after 1 June 2017. You may calculate the Administrative Fee and the arbitral tribunal's fee with the help of the calculator. (Please note that the arbitral tribunal's fee amounts given by the calculator are approximate and for guidance only.)

If the amount in dispute is in a currency other than euro, you may use the currency converter at: <http://www.oanda.com/currency/convert/>.

**Choose rules:**

Arbitration Rules of the Finland Chamber of Commerce

**Amount in dispute (EUR):**

Quick links

Search

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

18.11.2020 180

Arbitration is an **alternative dispute resolution method** to litigation in state courts. It is generally considered as the most effective means of resolving both domestic and international commercial disputes. Any dispute that can be settled by agreement between the parties may be referred to arbitration for final decision.

Arbitration has many advantages over litigation in state courts:

- Speed. Arbitration is faster than litigation.
- Flexibility. Arbitration is based on party autonomy. Parties may choose their arbitral tribunal. Further, they are free to tailor the arbitral proceedings to best suit their individual needs.
- Expertise. Parties and FAI may select arbitrators with optimal expertise, experience and other qualifications to resolve a specific dispute.
- Confidentiality. Contrary to court litigation, arbitration is a confidential method of settling business disputes.
- Finality and enforceability of the award. An arbitral award constitutes a legally enforceable decision. It is binding on the parties to the arbitration, and cannot be appealed on its merits. Pursuant to the New York Convention of 1958, arbitral awards are recognized and enforced in most countries in the world.

HOW TO INITIATE AN ARBITRATION	Rules: Arbitration Rules of the Finland Chamber of Commerce
COSTS OF ARBITRATION	Amount in dispute: EUR 200 000
FILING FEE	Number of arbitrators: 1
CALCULATOR (REQUESTS FOR ARBITRATION FILED ON OR AFTER 1 JUNE 2017)	<b>Administrative fee</b> Administrative fee EUR 5 500 The administrative fee is not subject to VAT.  <b>Arbitrator's fee</b> Minimum EUR 7 995 Median EUR 14 498 Maximum EUR 21 000  The arbitrator's fee amounts given by the calculator are approximate for guidance only. The fee amounts mentioned in the calculator do not include VAT or other charges that may be applicable to the fee of an arbitrator.
BANK ACCOUNT DETAILS	<b>Clear</b>

Some calculation examples.

In legal disputes, the only winners are lawyers.

Rules: Arbitration Rules of the Finland Chamber of Commerce
Amount in dispute: EUR 500 000
Number of arbitrators: 3
<b>Administrative fee</b> Administrative fee EUR 10 990 The administrative fee is not subject to VAT.  <b>Arbitral tribunal's fee</b> Minimum EUR 33 725 Median EUR 56 875 Maximum EUR 80 025

Rules: Arbitration Rules of the Finland Chamber of Commerce
Amount in dispute: EUR 10 000 000
Number of arbitrators: 1
<b>Administrative fee</b> Administrative fee EUR 33 000 The administrative fee is not subject to VAT.  <b>Arbitrator's fee</b> Minimum EUR 46 000 Median EUR 90 500 Maximum EUR 135 000

# Reuse

## Reuse in sw dev, 1

Software reuse could and should be even more than 50 %. At least if the company is making software products for the same, or similar, application areas.

However many companies do not code re-usable components from scratch in their projects, if they do not have another customer already in sight. Making a re-usable module takes about 1,5 x more time than "normal" sw dev.

On the other hand, companies may well have suitable software pieces already in-house, BUT

- how to find such ones from repository (name, place, documentation,...)
- developers usually think "nobody has done such function/procedure, and if has I don't find it easily, and it takes only one day to code it, so I do it myself".

So currently reuse may be something about 15-20 % only, heavily depending on company and application area.

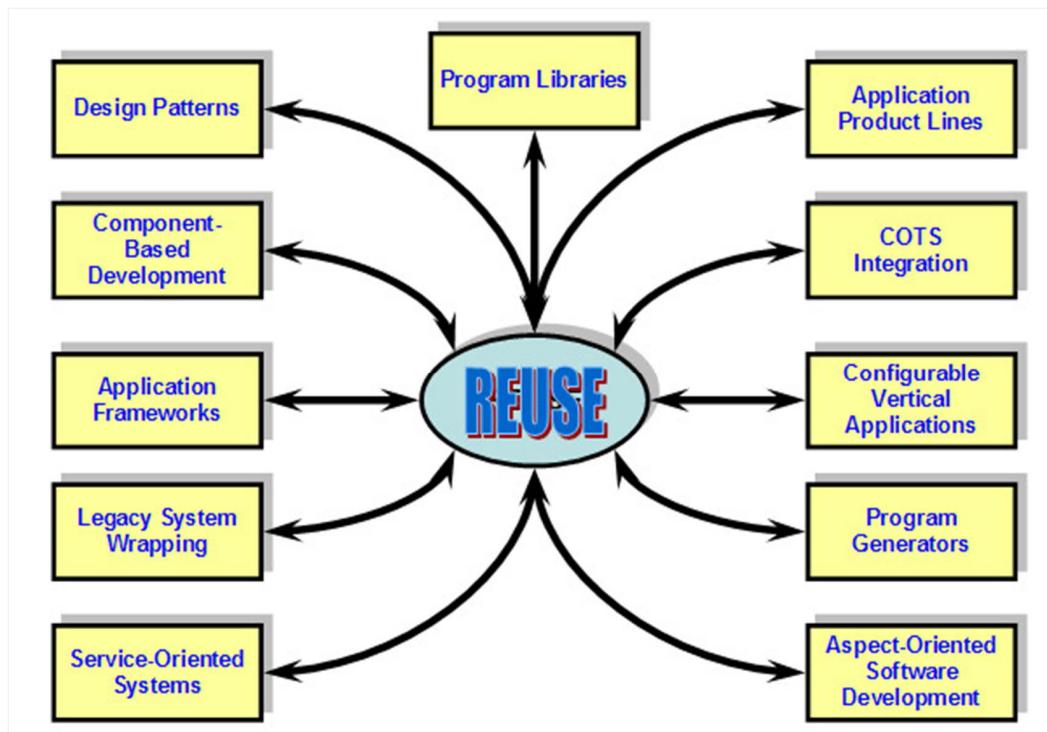
You don't want to hear from developers: "as this is meant for open source use, it is not supposed to work". (FI: "tää on avointa lähdekoodia, ei sen ole tarkoitukseen toimia")

## Reuse in sw dev, 2

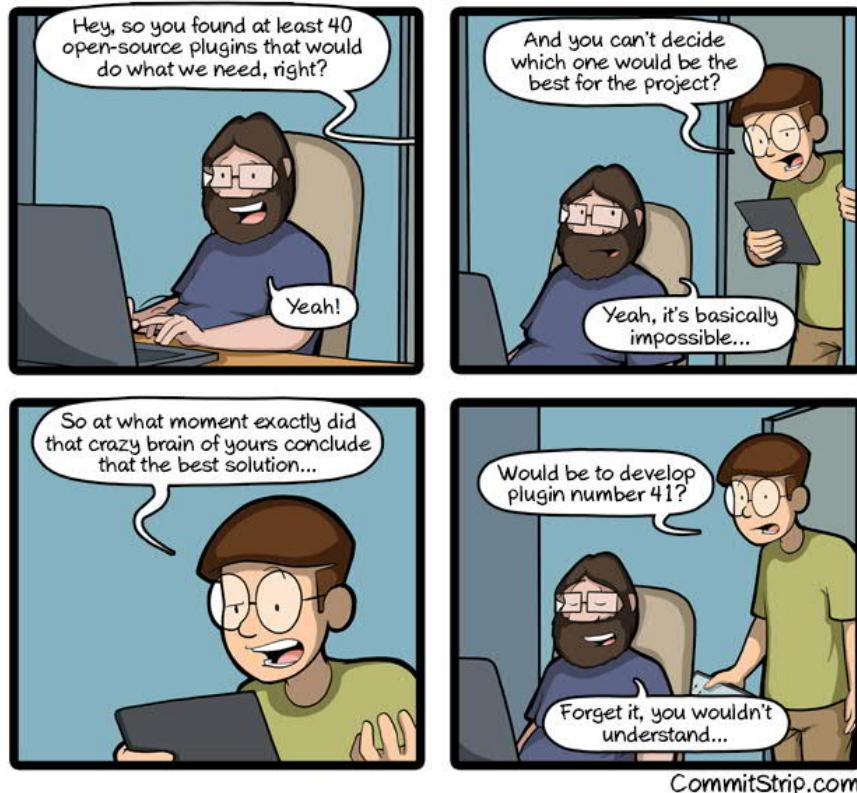
You can reuse e.g.

- requirements
- architecture plans
- code (self-made and 3rd party) components and libraries (open source or commercial)
- GUI components
- documentation (not mindless copy-pasting)
- tests (regression testing)
- ...

### [QR Code Library on the Base of Software Reuse Approach, 2013]



There are still problems,  
there should be more reuse.



CommitStrip.com

## Component-based development



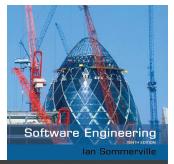
- ✧ **Component-based software engineering (CBSE)** is an approach to software development that relies on the reuse of entities called ‘software components’.
- ✧ It emerged from the failure of object-oriented development to support effective reuse. Single object classes are too detailed and specific.
- ✧ Components are more abstract than object classes and can be considered to be stand-alone service providers. They can exist as stand-alone entities.

## CBSE essentials



- ✧ Independent components specified by their interfaces.
- ✧ Component standards to facilitate component integration.
- ✧ Middleware that provides support for component inter-operability.
- ✧ A development process that is geared to reuse.

## Changes for reusability



- ✧ Remove application-specific methods.
- ✧ Change names to make them general.
- ✧ Add methods to broaden coverage.
- ✧ Make exception handling consistent.
- ✧ Add a configuration interface for component adaptation.
- ✧ Integrate required components to reduce dependencies.

## Highlights - What to remember

- There are many kind of software licenses, if you make commercial software, be careful what kind of license the components have (e.g. must you publish source code)
- if customer wants you to use personal ID (social security number) as client ID, suggest customer not to do such, it will be complex because of GDPR
- Big Data and IoT needs more and more real experts in near future
- there is a huge amount of Open Data available (APIs)
- there are many contract templates available (e.g. IT2018).
- reuse could be much more used inside software companies

Now the additional L11 extra slides are here

No time to show these at lectures, but otherwise good to know, at least if you are a major reader.

## Now the additional L11 extra slides are here

No time to show these at lectures, but otherwise good to know, at least if you are a major reader.

## Now the additional L11 extra slides are here

No time to show these at lectures, but otherwise good to know, at least if you are a major reader.

## Now the additional L11 extra slides are here

No time to show these at lectures, but otherwise good to know, at least if you are a major reader.

# Open source (OS)

# FOSS (free and open source software)

Free and open-source software (FOSS) allows users and programmers to edit, modify or reuse the software's source code. This gives developers the opportunity to improve program functionality by modifying it.

The term "free" indicates that the software does not have constraints on copyrights. The term "open source" indicates the software is in its project form, enabling easy software development from expert developers collaborating worldwide without any need for reverse engineering.

Free and open-source software may also be referred to as [free/libre open-source software \(FLOSS\)](#) or free/open-source software (F/OSS).

[[www.techopedia.com/](http://www.techopedia.com/)]

**Producing Open Source Software**

**How to Run a Successful Free Software Project**

by Karl Fogel

(Consulting: Open Tech Strategies, LLC)

2020-08-14:  
The 2nd Edition rewrite is finished and is all online below.  
Thanks to all the backers of the [campaign](#) that funded the rewrite!  
I'm doing a copy-editing and minor-improvements pass before sending it to the printer, for the reasons given in [this update](#).

*Producing Open Source Software* is a book about the human side of open source development. It describes how successful projects operate, the expectations of users and developers, and the culture of free software. The book is released under an [open copyright](#). You can buy it in bookstores, order copies from O'Reilly Media, or browse and download it here.

<b>English</b>	<b>Translations</b>	<b>Bonus Tracks</b>
<ul style="list-style-type: none"> <li>◦ <a href="#">Web (fast)</a></li> <li>◦ <a href="#">Web (one big page)</a></li> <li>◦ <a href="#">PDF (letter)</a></li> <li>◦ <a href="#">PDF (A4)</a></li> </ul>	<ul style="list-style-type: none"> <li>◦ <a href="#">Learn more / join a translation team</a></li> <li>◦ <a href="#">Dansk / Danish</a> <a href="#">HTML</a> <a href="#">of-site HTML</a></li> <li>◦ <a href="#">中文 (简体字) / Chinese</a> <a href="#">HTML</a> <a href="#">EPUB</a></li> </ul>	<ul style="list-style-type: none"> <li>◦ <a href="#">Reviews</a></li> <li>◦ <a href="#">Version control access</a></li> <li>◦ <a href="#">Other writings by Karl Fogel</a></li> <li>◦ <a href="#">BibTeX entry</a></li> </ul>

**Producing Open Source Software**

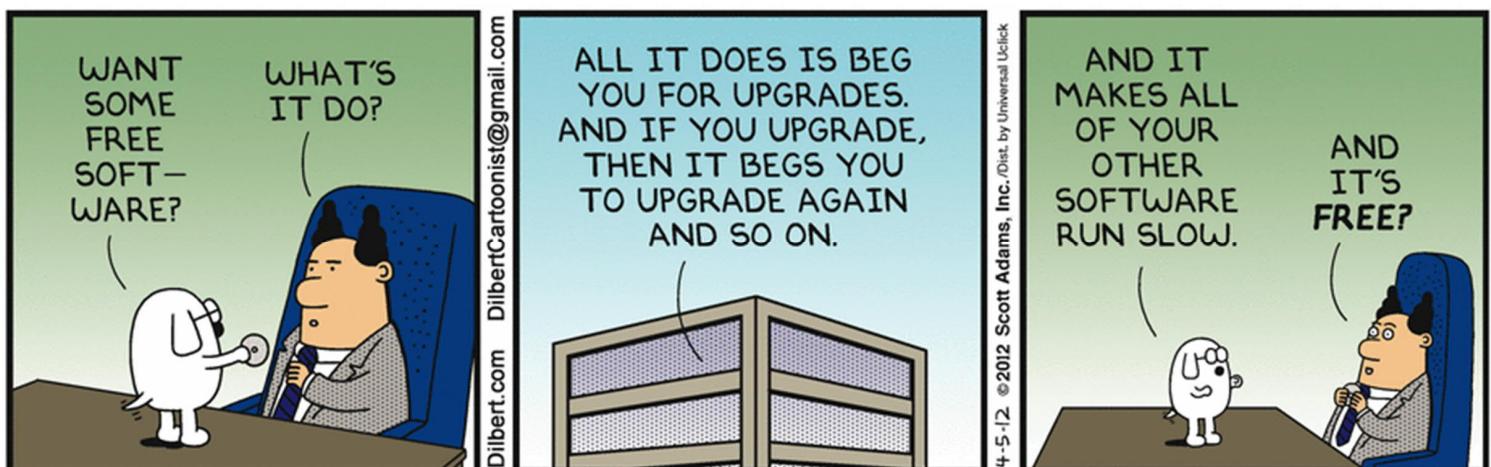
**How to Run a Successful Free Software Project**

Karl Fogel

**Producing Open Source Software: How to Run a Successful Free Software Project**

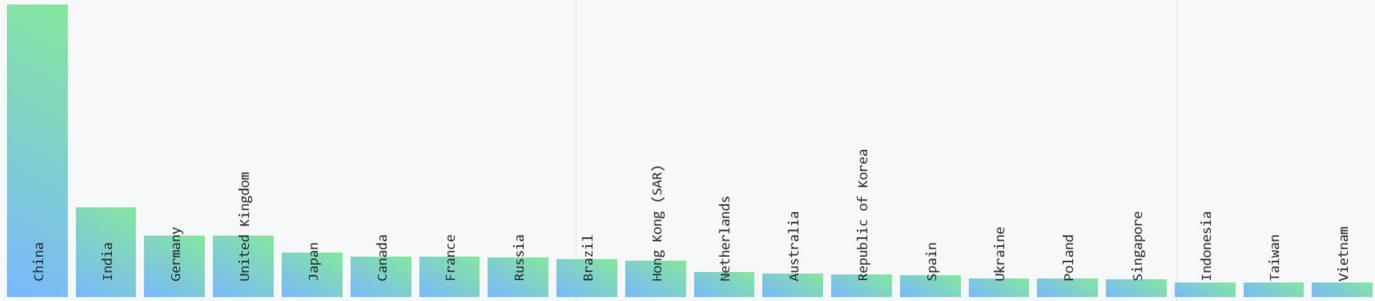
by Karl Fogel  
Copyright © 2005-2019 Karl Fogel, under the Creative Commons Attribution-ShareAlike (4.0) license.  
Version: 2.3168  
Home site: <https://producingoss.com/>

[<https://producingoss.com/>]





### Top 20 regions outside the US by open source use (clones and forks)



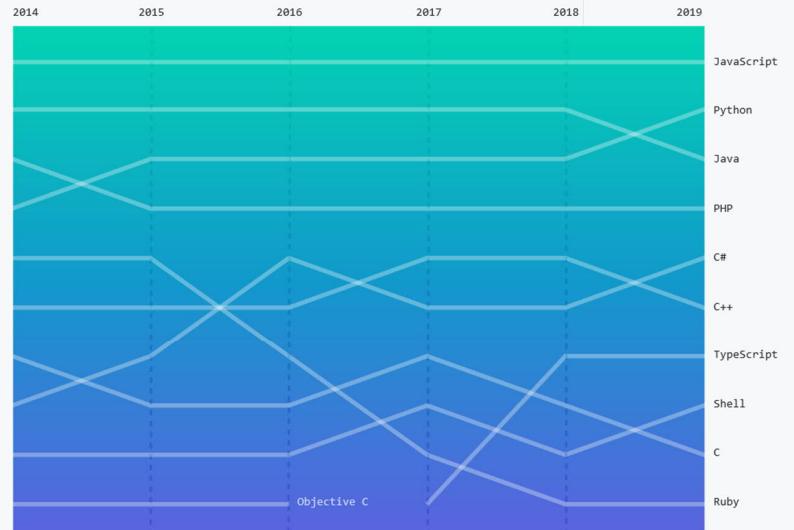
After the United States, open source use picked up speed in China, India, and Germany this year. Developers in China forked and cloned 48% more projects than last year.\*

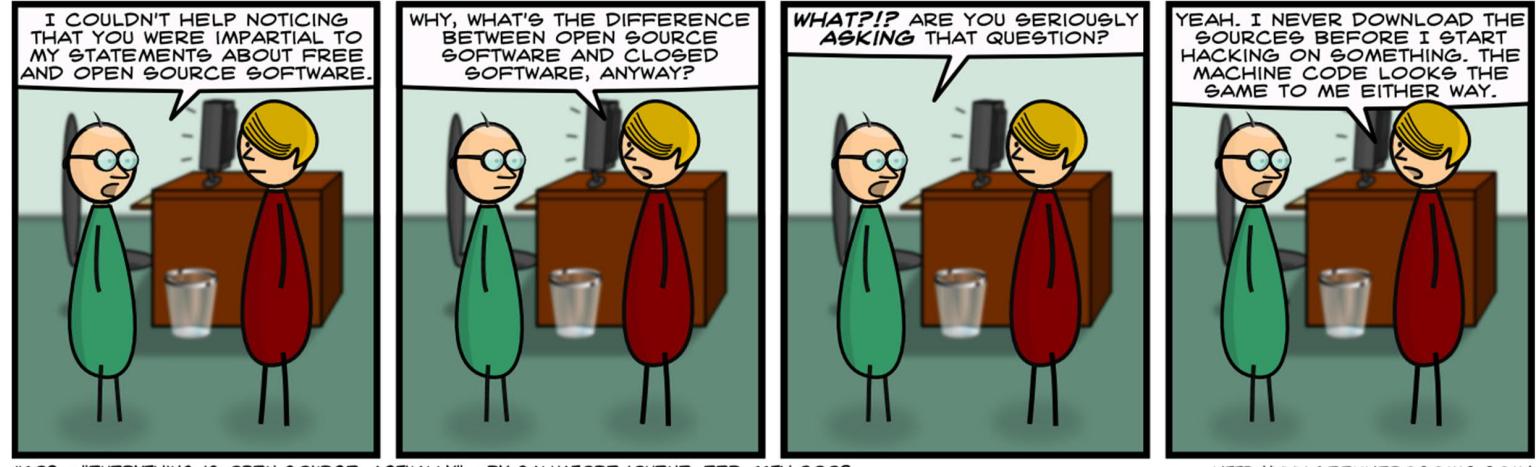


### Top languages over time

This year, C# and Shell climbed the list. And for the first time, Python outranked Java as the second most popular language on GitHub by repository contributors.\*

Most used programming languages at GitHub





## Open data

## Tampere

### City of Tampere open data

City of Tampere upkeeps catalog of open data sources: <http://data.tampere.fi/>

#### Tampere Reittiopas API

See: [Tampere Reittiopas API](#)

#### Tampere Public Transport SIRI Interface (Realtime)

See: [Tampere Public Transport SIRI Interface \(Realtime\)](#)

#### Tampere Public Transport SIRI Interface (Static)

See: [Tampere Public Transport SIRI Interface \(Static\)](#)

#### Tampere Public Transport GTFS feed

See: [Tampere Public Transport GTFS feed](#)

#### Other

#### European catalog on traffic related open data

See: <http://data.opencities.net/group/transport>



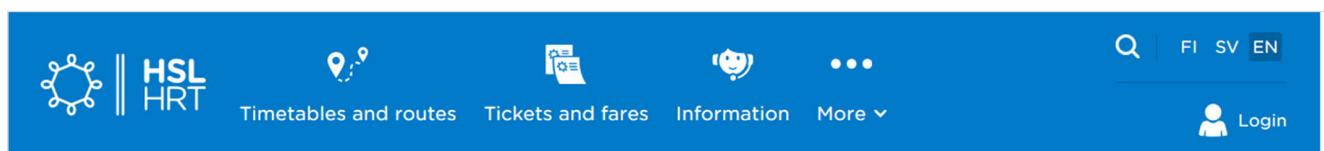
## Data sources in ITS Factory

Data source	Source	Documentation link
GTFS Dump files	Tampereen joukkoliikenne	<a href="http://wiki.itsfactory.fi/index.php/Tampere_Public_Transport_GTFS_feed">http://wiki.itsfactory.fi/index.php/Tampere_Public_Transport_GTFS_feed</a> What is GTFS? <a href="https://developers.google.com/transit/gtfs/">https://developers.google.com/transit/gtfs/</a>
Journeys API Realtime bus coordinates in JSON format as well as other public transport related data, such as: stops, lines, routes and schedules. Fully open, no accounts needed.	Tampereen joukkoliikenne	<a href="#">Documentation Link</a>
SIRI JSON	Tampereen joukkoliikenne	<a href="#">Documentation Link</a>
SIRI XML (please note that this url accepts HTTP POST requests and therefore does not open up in the browser)	Tampereen joukkoliikenne	<a href="#">Documentation Link</a>

[[wiki.itsfactory.fi](http://wiki.itsfactory.fi)]

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

18.11.2020 207



## Open data

### Open data in HSL

Helsinki Regional Transport Authority (HSL) offers open data both as interface services and data packages. Below we've listed all available data sets and APIs.

### Journey Planner APIs

The Journey Planner ([reittiopas.fi](http://reittiopas.fi)) APIs offer data regarding routing, geocoding, map data and vehicle locations through several APIs...

- [Routing API](#), Itinerary- and timetable-queries via either a [GraphQL-API](#) or a [REST-API](#)
- [Geocoding API](#), [Pelias REST-interface](#)
- [Map API](#), HSL's background map as a TMS-service ([Tile Map Service](#)) and a number of public transport related points of interest (e.g. ticket vending points, city bike stations & park and ride sites) as [Mapbox vectortile-services](#).
- [Realtime API](#), [GTFS-RT](#) & [MQTT](#)-feeds

Further information : [digitransit.fi](http://digitransit.fi)

The public transport network data is updated daily from HSL's public transport register to the journey planner APIs (see below). The OpenStreetMap data is also updated daily to the journey planner for routing graph, geocoding and background map purposes. Due to different cache-settings, the changes in the background map become visible to the users in about one week's time.

### Public transport network & timetables (GTFS)

<https://www.hsl.fi/en/opendata>

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

18.11.2020 208

Open Data

- [Terms of use](#)
- [Materials](#)
- [Digiroad](#)
- [Digitraffic](#)
- [View and download services](#)

## Open data

Finnish Transport Infrastructure Agency supports transport and in Finland by offering its data openly for the public.



[vayla.fi/web/en/open-data](http://vayla.fi/web/en/open-data)

**Open data programme in the Finnish Transport Infrastructure Agency**

naomi korn

ASSOCIATES

+44 203 475

SERVICES ▾      OUR CLIENTS      OUR TEAM      NEWS

**COPYRIGHT ESSENTIALS**

- [A Basic Introduction to Copyright](#) (2020) Free 1 hour webinar introduction in partnership with DP Tripathi, Assistant Librarian at Biju Patnaik Central Library
- [Copyright Fact Sheet](#) (2019) Overview of copyright key points and definitions
- [Copyright Checklists](#) (2019) Reasonable searches checklists, top tips and related risks
- [Exceptions to Copyright](#) (2019) Guidance regarding the UK's exceptions for educational establishments
- [A History of Copyright](#) (2019) Origination of copyright laws and information
- [Orphan Works Guidance](#) (2019) Guidance regarding tools and techniques
- [IP and Copyright: Licensing & Protecting within DAMS](#) (2020) Pre-recorded presentation
- [Copyright for artists](#) (2020) Top tips about copyright for artists

**DATA PROTECTION ESSENTIALS**

- [FAQS Data Protection](#) (2018) by Naomi Korn Associates Ltd

**JISC**  **RLUK** Research Libraries UK

**Licensing Open Data: A Practical Guide**  
Naomi Korn and Professor Charles Oppenheim, June 2011 version 2.0<sup>1</sup>

**Introduction**

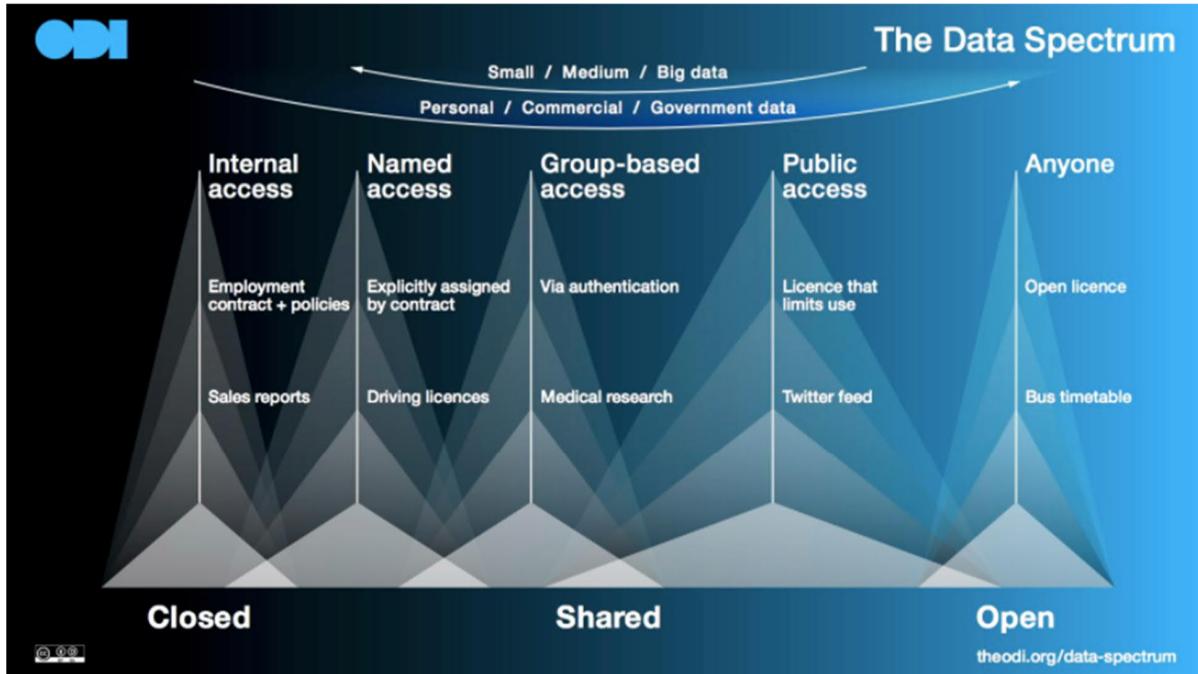
This Guide has been developed for organisations who are considering the issues associated with licensing open data and/or want to understand the terms under which they can use data which has been licensed by third parties. It provides a practical overview of the various legal issues which might arise in the context of licensing open data, as well as the different types of licences which are available.

**This Guide has been divided into the following sections:**

- Section One: Legal Constraints to Achieving Open Data**
  - Intellectual Property Rights
  - Contract Law
  - Data Protection
  - Freedom of Information
  - Breach of Confidence
- Section Two: Open Data Licences**
  - Creative Commons Licences
  - CC Zero
  - Open Data Commons
  - The Open Government Licence
- Section Three: How Open are So-Called 'Open' Licences?**
  - Importance of Data
  - Open Licence Comparison Table for Data
  - Truly Open Licences
- Section Four: When Might Open Licences NOT be Appropriate to Use?**
  -
- Section Five: Want to Find Out More?**
  -



[<https://theodi.org/about-the-odi/the-data-spectrum/>]



## Big data

<https://www.big-data-europe.eu/>



TUNI \* COMP.SE.100-EN Introduction to Sw Eng

18.11.2020 213

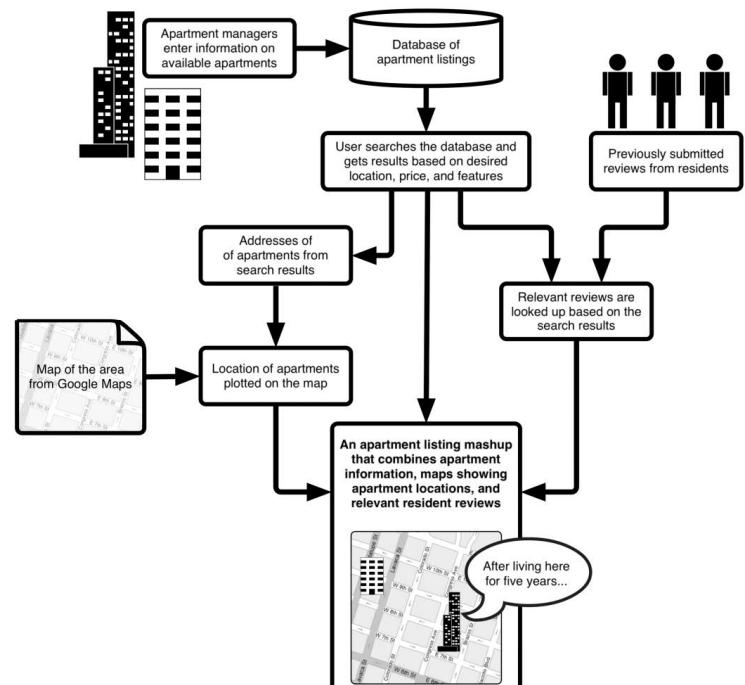
## An Exploration of Mashups and Their Potential Educational Uses

Min Liu  
Lucas Horton  
Justin Olmanson  
Pei-Yu Wang

**ABSTRACT.** A Web mashup is an application that combines data and functionality from more than one source. By bringing disparate data together in ways that enable users to do new things or accomplish common tasks with newfound efficiency, mashups are rapidly increasing in number and may offer exciting new possibilities for classroom instruction. However, in comparison to more established Web 2.0 applications such as wikis, blogs, and podcasts, which already enjoy a place in the educational conversation, mashups are less well-known and their educational uses are less explored. The purpose of this article, therefore, is to provide an introduction to mashups as part of Web 2.0 technology, describe several mashup examples, and explore their potential use in educational contexts.

[2008]

FIGURE 1. Visual illustration of how ApartmentRatings.com mashup works.



TUNI \* COMP.SE.100-EN Introduction to Sw Eng

18.11.2020 214

A good source for big data...

BTW. Can you test all the features ? And all combinations of user actions ??

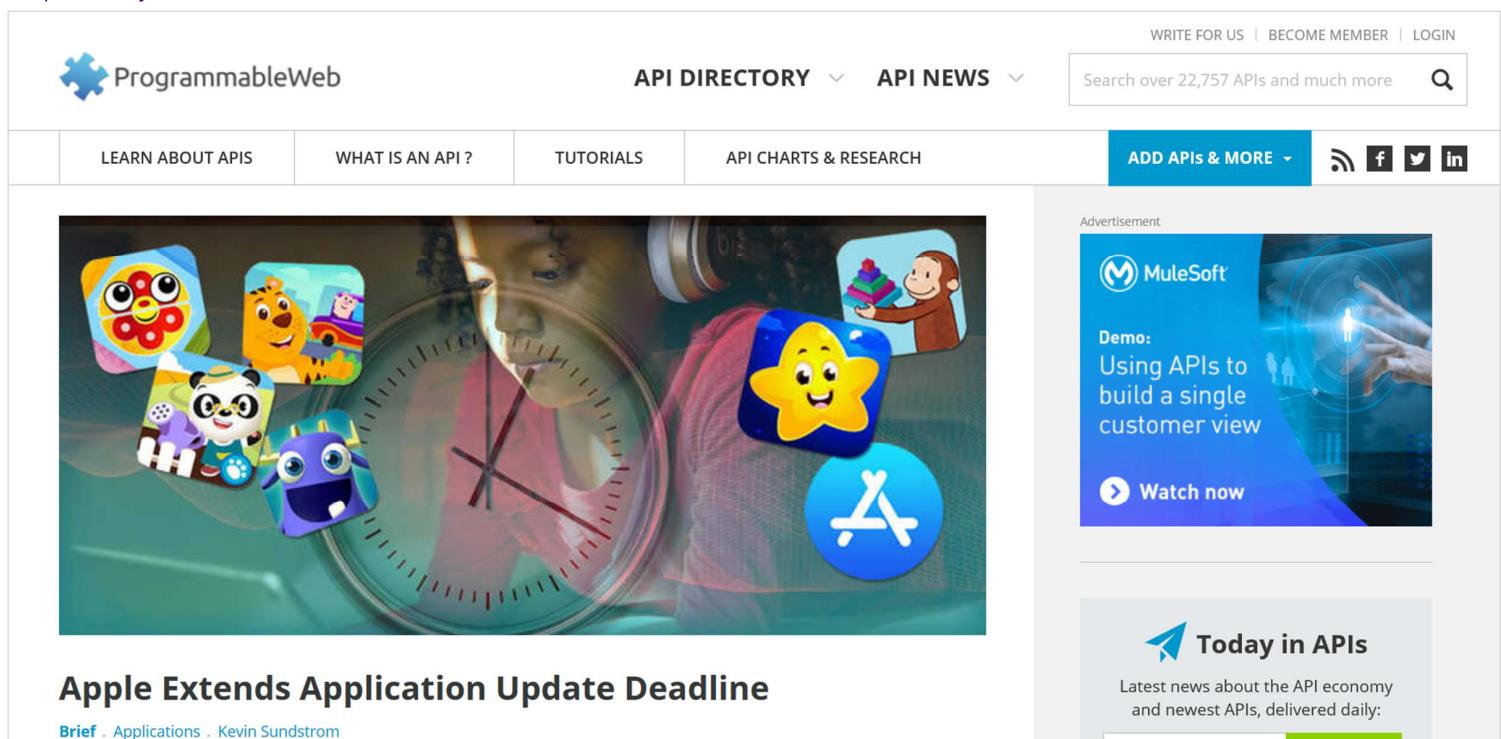
[<https://www.getzephyr.com/resources/whitepapers/iot-and-its-impact-testing>]

TUNI \* COMP.SE.100-EN Introduction to Sw Eng



18.11.2020 215

[www.programmableweb.com/](http://www.programmableweb.com/)



ProgrammableWeb

API DIRECTORY API NEWS ADD APIs & MORE

Search over 22,757 APIs and much more

Advertisement

MuleSoft

Demo:  
Using APIs to build a single customer view

Watch now

Today in APIs

Latest news about the API economy and newest APIs, delivered daily:

## Apple Extends Application Update Deadline

Brief . Applications . Kevin Sundstrom

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

18.11.2020 216


LEARN ABOUT APIs
WHAT IS AN API ?
API NEWS
API DIRECTORY

Search over 22,757 APIs and much more






## The Latest News On The API Economy

Search ProgrammableWeb News
**SEARCH ARTICLES**

Filter Articles
[Show Advanced Filters](#)

### How to Extract COVID-19 Keywords from News Using Python

Developer Gilvandro Neto has written a tutorial for extracting keywords from 100k+ articles and publications. Using Python and NLP techniques, with the coronavirus (COVID-19) as a sample topic, Neto walks us through the four steps of his project: setup, coding, conclusion, and future work.

[How-To · Katherine Harrison-Adcock · Data Mining, Coronavirus · 03-11-2020](#)

### Make Your Own Zillow, An Overview of the Zillow Tech Stack

TUNI \* COMP.SE.100-EN Introduction to Sw Eng
18.11.2020
217


API UNIVERSITY

FEATURED
LATEST

#### FOR API PROVIDERS

[What Are APIs and How Do They Work?](#)

[Guide to GraphQL: Understanding, Building and Using GraphQL APIs](#)

[How Facebook Makes it Nearly Impossible For You To Quit](#)

[More for API Providers >](#)

#### FOR DEVELOPERS

[How to Get Started With Google Actions](#)

[How to Build a Monitoring Application With the Google Cloud Vision API](#)

[How to Access Any RESTful API Using the R Language](#)

[More for Developers >](#)

Tampereen yliopisto  
Tampere University



## DATA NEVER SLEEPS 7.0

How much data is generated *every minute*?

There's no way around it: big data just keeps getting bigger. The numbers are staggering, and they're not slowing down. By 2020, there will be *60x* more bytes of data than there are stars in the observable universe. In our 7th edition of Data Never Sleeps, we bring you the latest stats on how much data is being created in every digital minute.

SOURCES: STATISTA, INTERNET LIVE STATS, EXPANDED RAMBLINGS, NATIONAL ASSOCIATION OF CITY TRANSPORTATION OFFICIALS, WIRED

The infographic is a circular diagram divided into 24 segments, each representing a minute of the day. The segments are color-coded and contain the following data:

- #LOVE IS POSTED 23,211 TIMES
- GIPHY SERVES UP 4,800,000 GIFS
- NETFLIX USERS STREAM 694,444<sup>hrs</sup> OF VIDEO
- GRUBHUB RECEIVES 8,683 ORDERS
- INSTAGRAM USERS POST 277,777 STORIES
- YOUTUBE USERS WATCH 4,500,000 VIDEOS
- TWITTER USERS SEND 511,200 TWEETS
- SKYPE USERS MAKE 231,840 CALLS
- INSTAGRAM USERS POST 55,140 PHOTOS
- AMERICANS USE 4,416,720 GB OF INTERNET DATA
- AIRBNB BOOKS 1,389 RESERVATIONS
- UBER USERS TAKE 9,772 RIDES
- VENMO PROCESSES \$162,037 TRANSACTIONS
- TINDER USERS SWIPE 1,400,000 TIMES
- GOOGLE CONDUCTS 4,497,420 SEARCHES
- 18,100,000 TEXTS ARE SENT
- 390,030 APPS ARE DOWNLOADED
- TUMBLR USERS PUBLISH 92,340 POSTS
- TWITCH USERS VIEW 1,000,000 VIDEOS
- 2019 *every* MINUTE *of the* DAY *the* PRESENTED BY DOMO

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

18.11.2020 218

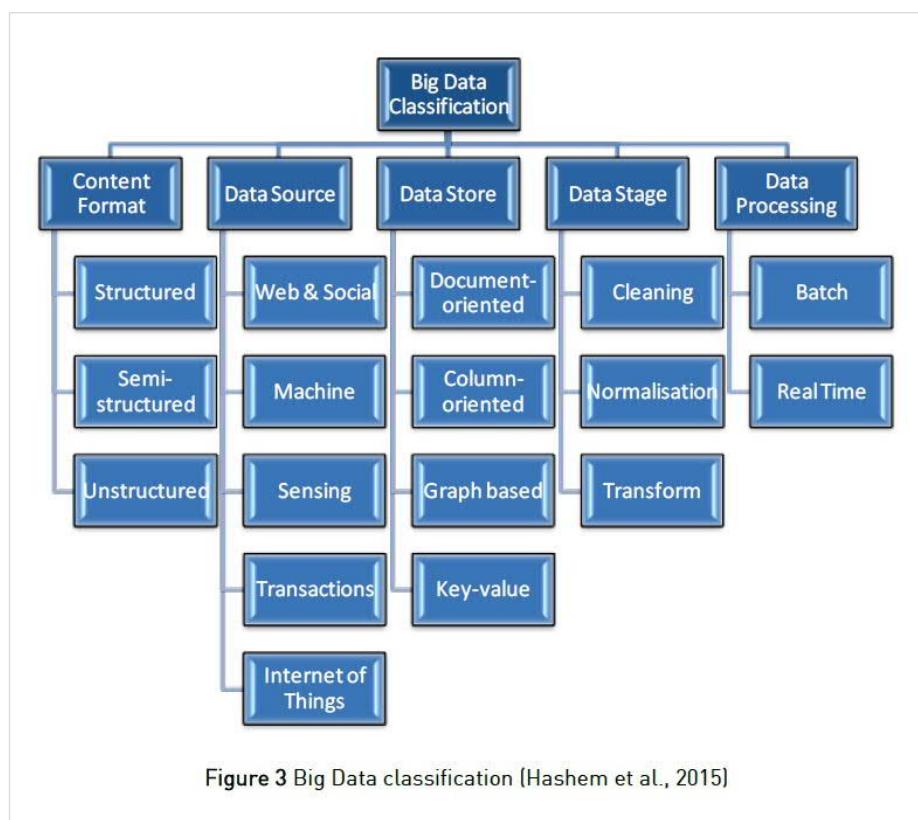
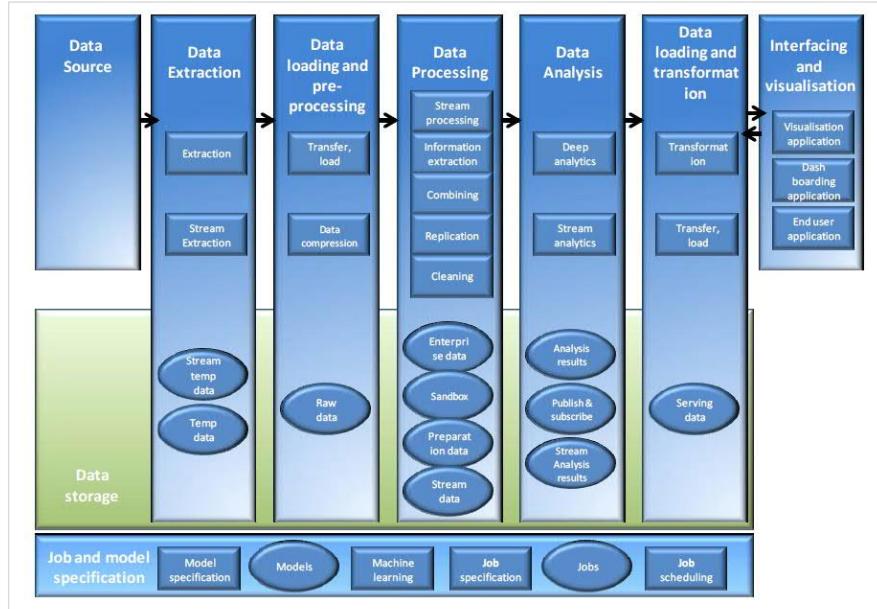
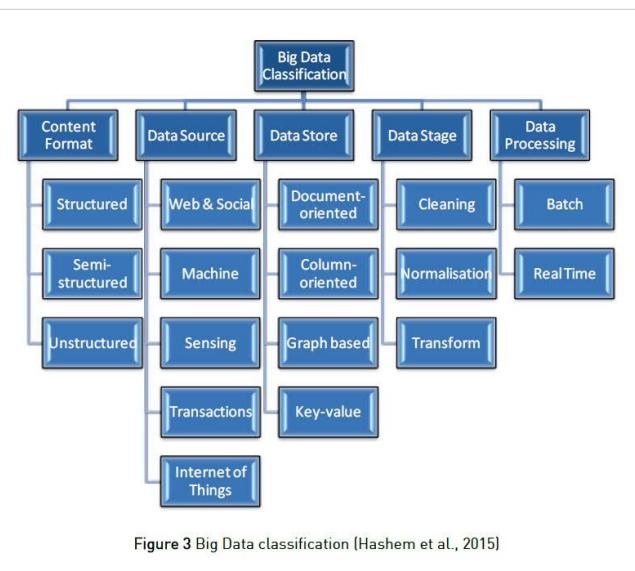
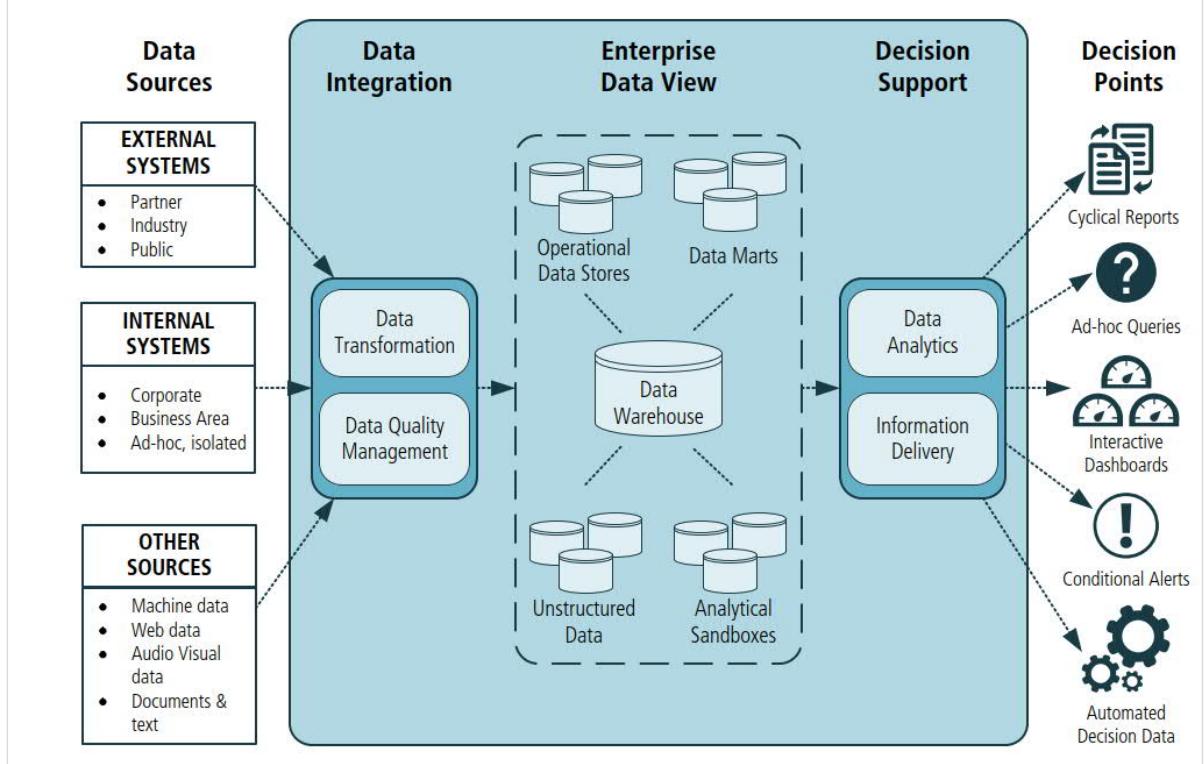


Figure 11.2.1: Business Intelligence Solution - Conceptual Framework



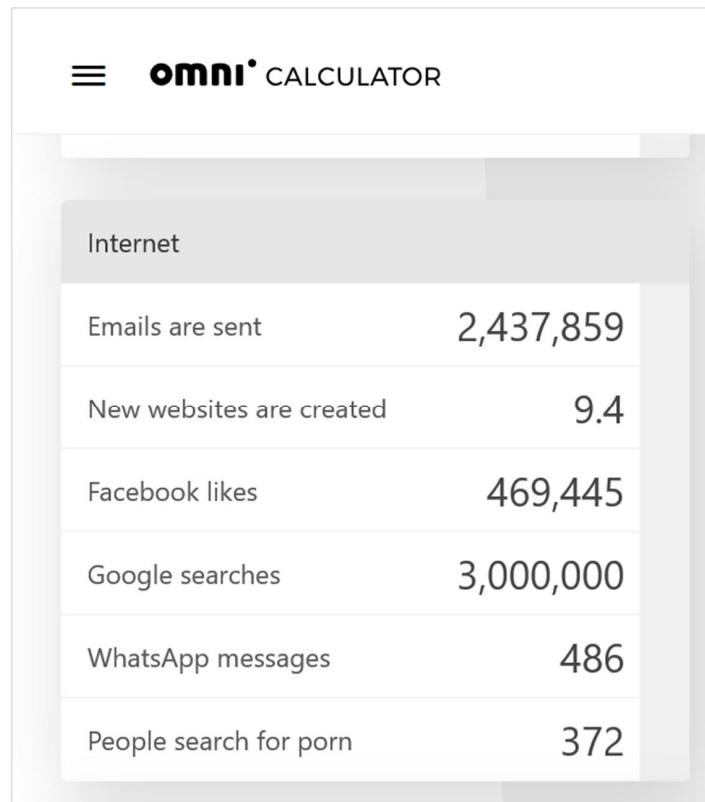
[https://bigdatawg.nist.gov/V3\\_output\\_docs.php](https://bigdatawg.nist.gov/V3_output_docs.php)

## NIST Big Data interoperability Framework (NBDIF)

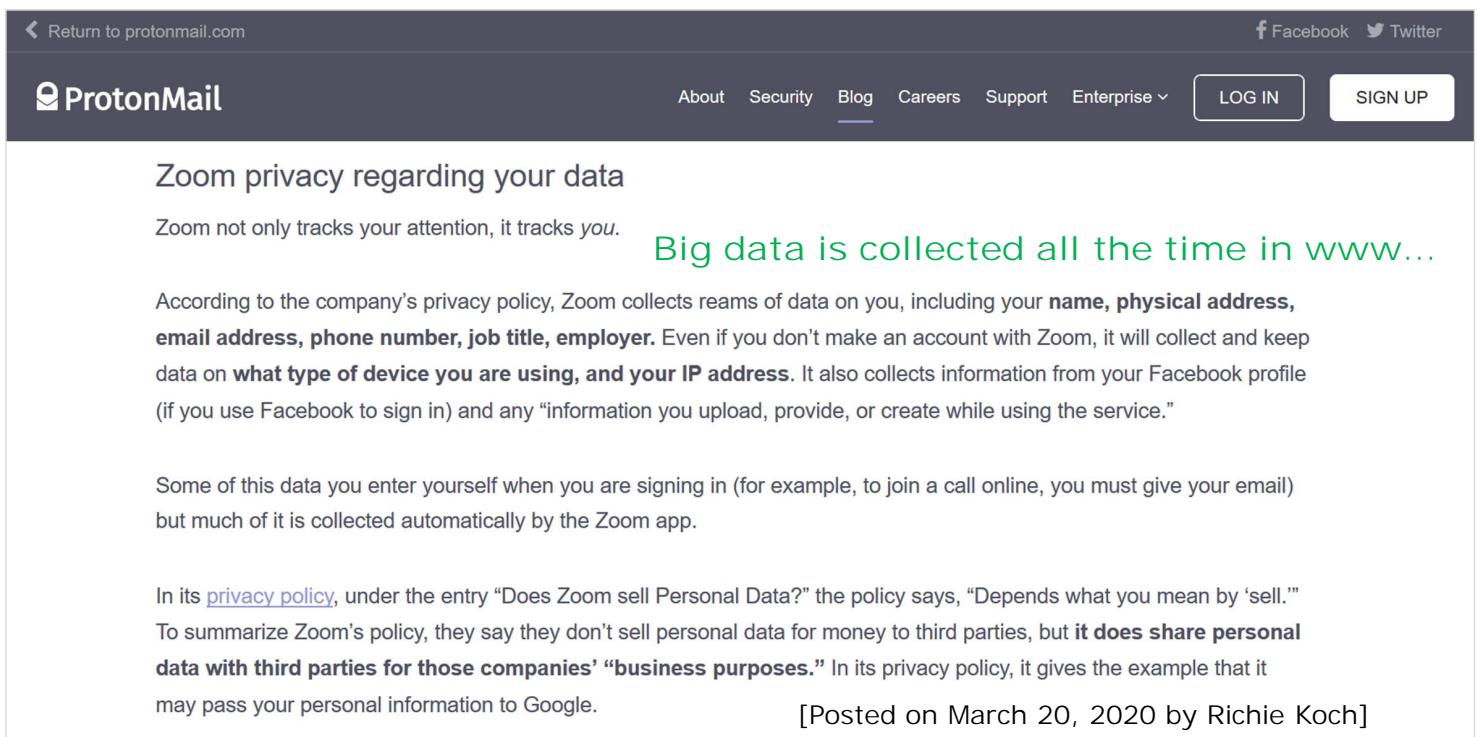
V3.0 Final Version

<p><b>Documents</b></p> <p><a href="#">NBDIF V3 Final</a>  <a href="#">NBDIF V2 Final</a>  <a href="#">NBDIF V1 Final</a>  <a href="#">Docs Repository</a>  <a href="#">Use Cases Listing</a>  <a href="#">Upload Document</a></p> <hr/> <p><b>Registration</b></p> <p><a href="#">New User</a>  <a href="#">Update Profile</a></p> <hr/> <p><b>Points of Contact</b></p> <p>Wo Chang  NIST / ITL  Digital Data Advisor</p> <p>James St Pierre  NIST / ITL  Deputy Director</p>	<p><b>NIST Big Data Definitions &amp; Taxonomies Subgroup</b></p> <ol style="list-style-type: none"> <li><a href="#">NIST SP 1500-1r2</a> -- Volume 1: Definitions</li> <li>NIST SP 1500-2r2 -- Volume 2: Taxonomies (** Available soon **)</li> </ol> <p><b>NIST Big Data Use Case &amp; Requirements Subgroup</b></p> <ol style="list-style-type: none"> <li><a href="#">NIST SP 1500-3r2</a> -- Volume 3: Use Case &amp; Requirements</li> </ol> <p><b>NIST Big Data Security &amp; Privacy Subgroup</b></p> <ol style="list-style-type: none"> <li><a href="#">NIST SP 1500-4r2</a> -- Volume 4: Security and Privacy</li> </ol> <p><b>NIST Big Data Reference Architecture Subgroup</b></p> <ol style="list-style-type: none"> <li><a href="#">NIST SP 1500-5</a> -- Volume 5: Architectures White Paper Survey</li> <li><a href="#">NIST SP 1500-6r2</a> -- Volume 6: Reference Architecture</li> </ol> <p><b>NIST Big Data Technology Roadmap Subgroup</b></p> <ol style="list-style-type: none"> <li><a href="#">NIST SP 1500-7r2</a> -- Volume 7: Standards Roadmap</li> </ol> <p><b>Two New Volumes</b></p> <ol style="list-style-type: none"> <li><a href="#">NIST SP 1500-9r1</a> -- Volume 8: Reference Architecture Interface</li> <li><a href="#">NIST SP 1500-10r1</a> -- Volume 9: Modernization and Adoption</li> </ol>	<p><b>IEEE NBD-PWG Workshop, October 27, 2014</b></p> <p><b>1st NIST Big Data Workshop, NIST, September 30, 2013</b></p> <hr/> <p><b>Useful References</b></p> <p><a href="#">National Privacy Research Strategy, June 24, 2016</a>  <a href="#">The Federal Big Data Research and Development Strategic Plan, May 19, 2016</a>  <a href="#">Interim Progress Report on Big Data: Seizing Opportunities, Preserving Values, February, 2015</a>  <a href="#">PCAST Report on Big Data and Privacy: A Technological Perspective, May, 2014</a>  <a href="#">Big Data: Seizing Opportunities,</a></p>
---	---	--

Every second...



<https://protonmail.com/blog/zoom-privacy-issues/>



**Zoom privacy regarding your data**

Zoom not only tracks your attention, it tracks *you*. **Big data is collected all the time in www...**

According to the company's privacy policy, Zoom collects reams of data on you, including your **name, physical address, email address, phone number, job title, employer**. Even if you don't make an account with Zoom, it will collect and keep data on **what type of device you are using, and your IP address**. It also collects information from your Facebook profile (if you use Facebook to sign in) and any "information you upload, provide, or create while using the service."

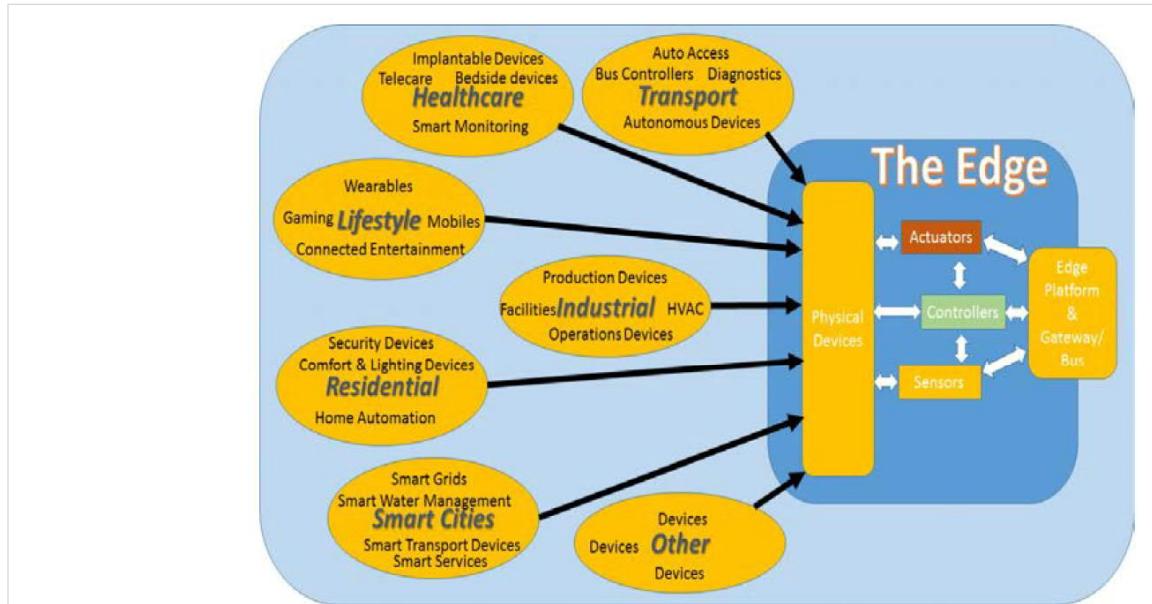
Some of this data you enter yourself when you are signing in (for example, to join a call online, you must give your email) but much of it is collected automatically by the Zoom app.

In its [privacy policy](#), under the entry "Does Zoom sell Personal Data?" the policy says, "Depends what you mean by 'sell.'" To summarize Zoom's policy, they say they don't sell personal data for money to third parties, but **it does share personal data with third parties for those companies' "business purposes."** In its privacy policy, it gives the example that it may pass your personal information to Google.

[Posted on March 20, 2020 by Richie Koch]

# IoT edge

In today's IoT system architectures, the concept of the "edge" refers to the aspect that comprises the operational domain of the overall IoT system.



**Figure 2-1 | Typical edge environment**

[A Survey on the Edge Computing for the Internet of Things, 2018]

W. Yu et al.: Survey on the Edge Computing for the IoT

**TABLE 1. Characteristics of IoT, edge and cloud computing.**

	IoT	Edge	Cloud
Deployment	Distributed	Distributed	Centralized
Components	Physical devices	Edge nodes	Virtual resources
Computational	Limited	Limited	Unlimited
Storage	Small	Limited	Unlimited
Response Time	NA	Fast	Slow
Big data	Source	Process	Process

# Internet of Things (IoT)



## Different steps of evolution of the Internet of Things

### **1. Data driven innovation in vertical sectors**

Connected sensors collect data from objects (e.g. a car, a phone etc.) These data are analysed either through embedded systems or through cloud-based and Internet systems enabling the creation of new services and big data analytics. Wearables, sensors, equipment parts in business and smart city environments are examples of solutions put forward in this step. Innovation is data- and product-driven and provides better decision making, increased efficiency and more convenience. This happens at the level of vertical sectors, but cross-cutting exchanges remain limited.

### **2. Industrial IoT: actuation and semi-autonomous behaviour based on smart connected objects**

The data provided by connected sensors and objects allows single and networked objects to perform specific functions derived from sensing, analysis and intelligence gathered. This operates normally within the boundaries of given applications but it is expected, with increasing computing power and sophistication to gain high levels of autonomy in their behaviour and "life". Examples include factory automation, logistics and robotics.

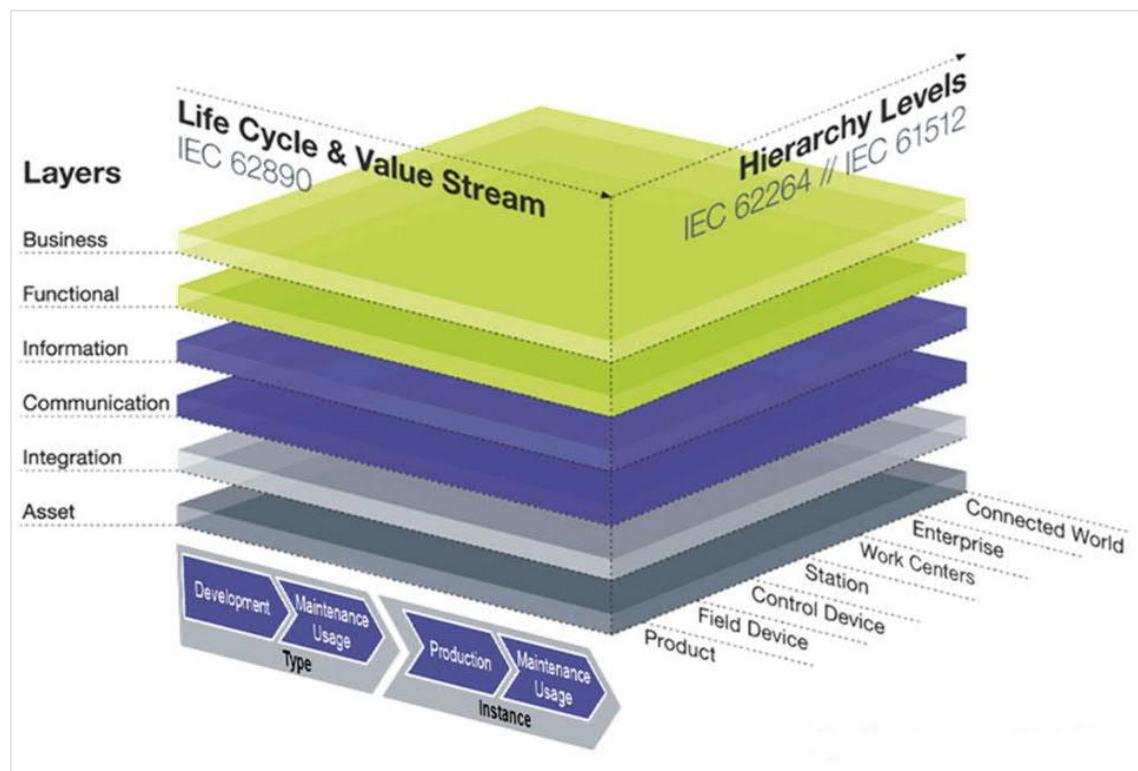
### **3. Programmable world: data exchange and service creation across large vertical applications**

The third step combines steps one and two by using complex systems, intelligence and actuation. Sensors and Smart connected objects are not only designed and optimised to perform certain functions on the basis of vertical business models. They become part of a bigger connectivity network which creates new opportunities to combine more intelligence and actuation across vertical markets (verticals), to provide a whole new set of services and to coordinate smart objects in their original or other functions. Technical and semantic interoperability are the key factor of success. It enables the programming of complex systems to integrate a number of device- and service providers to deliver complete IoT solutions e.g. at home, in cities, between industries.

### **4. The age of the digital nature**

Connected objects of all sorts become autonomous, using artificial intelligence to learn and self-improve. Natural and cyborg interfaces link people with their hyper-connected environments and optimise these objects' functionalities seamlessly, like in a new stage of nature. This stage implies objects making decisions on their own to simplify our everyday life. The basic design is intended to meet the needs and preferences of individuals and society.

The three axes represent all essential aspects of Industrie 4.0. They make it possible to classify an object such as a machine in the model. Thus, highly flexible Industrie 4.0 concepts can be described and implemented with RAMI 4.0. The Reference Architecture Model allows a step-by-step migration from the actual to the Industrie 4.0 world.



## RAMI 4.0 (Reference Architecture Model Industrie 4.0)

### Axis "Hierarchy Levels"

On the right horizontal axis are the hierarchical levels from IEC 62264, the international series of norms on the integration of company IT and control systems. These hierarchy levels represent the different functionalities within the factory or plant.

### Axis "Life Cycle & Value Stream"

The left horizontal axis represents the life cycle of plants and products. The basis for this is IEC 62890 on life cycle management. A distinction is also made between type and instance. A "type" becomes an "instance" when the development and prototype production is completed and the actual product is manufactured in the production department.

### Axis "Layers"

With the help of the six layers on the vertical axis of the model, the IT representation, i.e. the digital image of a machine, for example, is described in a structured way layer by layer. The representation in layers comes from information and communication technology. In this field it is common practice to structure complex products in layers.



## CITYIOT – RATKAISUJA KAUPUNKIEN DIGIMURROKSEEN

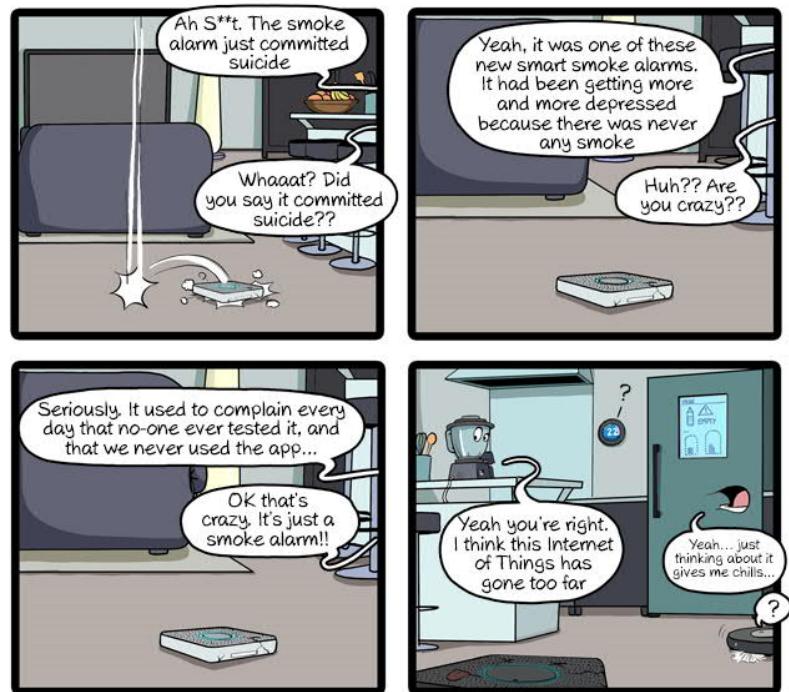


18.11.2020

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

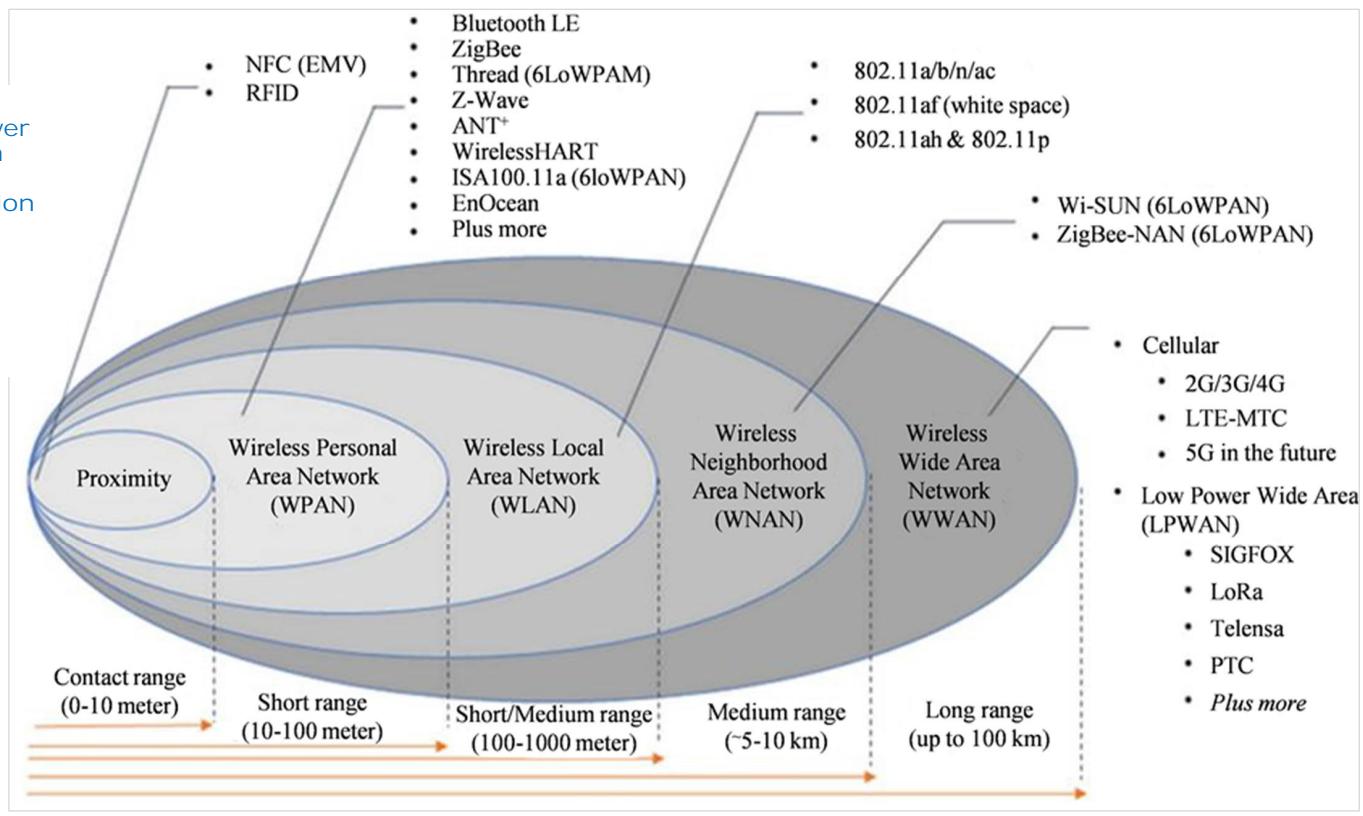
231

Tampereen yliopisto  
Tampere University



CommitStrip.com

[A Study of Efficient Power Consumption Wireless Communication Techniques/ Modules for Internet of Things (IoT) Applications, 2016]



[<https://www.iiconsortium.org/>] 2019

## Vocabulary

## 3: Relationship with Other IIC Documents

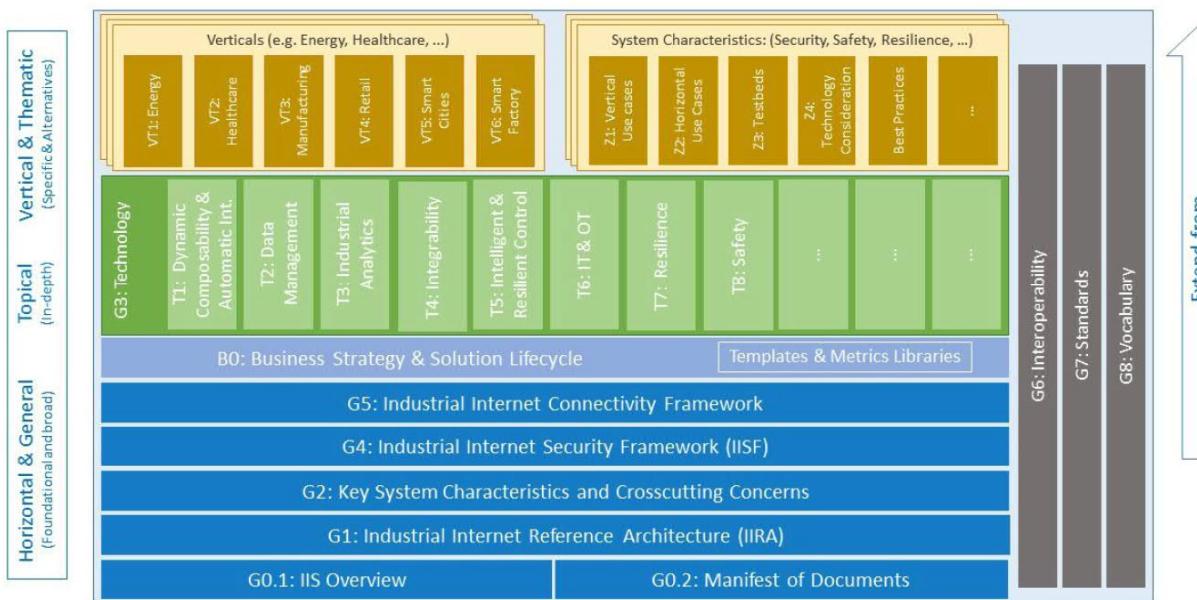


Figure 3-1: IIC Technical Publication Organization



The Industrial Internet of Things  
Vocabulary

An Industrial Internet Consortium Framework Publication  
Version V2.3 – 2020-10-05

Claude Baudoin (IIC), Erin Bournival (Dell Technologies), Marcellus Buchheit (Wibu-Systems),  
Ruben Guerrero (Toshiba)



Standards About us News Taking part Store EN

ICS > 35 > 35.020

# ISO/IEC 20924:2018

## Information technology – Internet of Things (IoT) – Vocabulary

The electronic version of this International Standard can be downloaded from the ISO/IEC Information Technology Task Force (ITTF) web site.

**ABSTRACT** [PREVIEW](#)

ISO/IEC 20924:2018(E) provides a definition of Internet of Things along with a set of terms and definitions forming a terminology foundation for the Internet of Things

**BUY THIS STANDARD**

FORMAT  PAPER LANGUAGE [English](#)

CHF 58 [BUY](#)

## IoT, esineiden internet, 4

- JTC 1/wg 10 Internet of Things

### ISO working group

- ISO/IEC JTC 1/SC 41 , Internet of things and related technologies

### Working group projects

- ISO/IEC 20924 ED1 , Internet of Things (IoT) - Vocabulary

# JTC 1 SC 41 IoT

## White Papers

- Internet of Things: Wireless Sensor Networks
- IoT 2020: Smart and secure IoT platform
- Edge intelligence

## ISO/IEC JTC 1/SC 41 Internet of Things and related technologies

[<https://www.iso.org/committee/6483279.html>]

18.11.2020

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

237



## IoT standardisation, some already published standards

10

### IoT-standardointi

**SESKO**

#### — SC 41:n valmiita standardijulkaisuja

ISO/IEC 19637:2016 Information technology - Sensor network testing framework

ISO/IEC 20005:2013 Information technology - Sensor networks - Services and interfaces supporting collaborative information processing in intelligent sensor networks

ISO/IEC 20924:2018 Internet of Things (IoT) – Vocabulary

ISO/IEC 21823-1:2018 PRV Internet of Things (IoT) - Interoperability for IoT systems - Part 1: Framework

ISO/IEC TR 22417:2017 Information technology - Internet of things (IoT) - IoT use cases

ISO/IEC TR 22560:2017 Information technology - Sensor network - Guidelines for design in the aeronautics industry: Active air-flow control

ISO/IEC 29182 Information technology - Sensor networks: Sensor Network Reference Architecture (SNRA)

• Part 1: General overview and requirements

• Part 2: Vocabulary and terminology

• Part 3: Reference architecture views

• Part 4: Entity models

• Part 5: Interface definitions

• Part 6: Applications

• Part 7: Interoperability guidelines

ISO/IEC 30101:2014 Information technology -- Sensor networks: Sensor network and its interfaces for smart grid system

ISO/IEC 30128:2014 Information technology -- Sensor networks -- Generic Sensor Network Application Interface

ISO/IEC 30140 Information technology -- Underwater acoustic sensor network (UWASN)

• Part 1: Overview and requirements

• Part 2: Reference architecture

• Part 3: Entities and interfaces

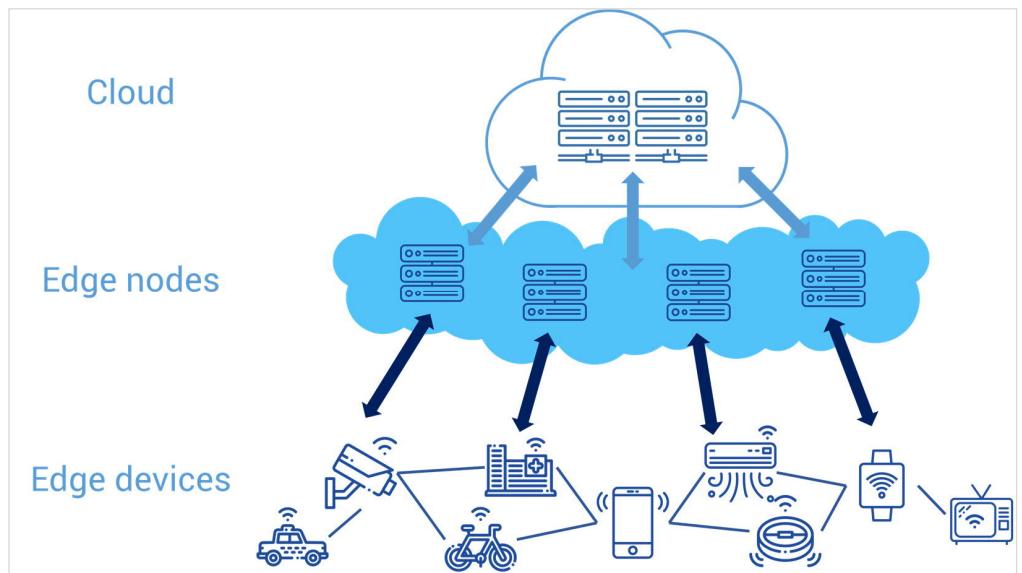
• Part 4: Interoperability

ISO/IEC 30141:2018 Information technology - Internet of Things Reference Architecture (IoT RA)



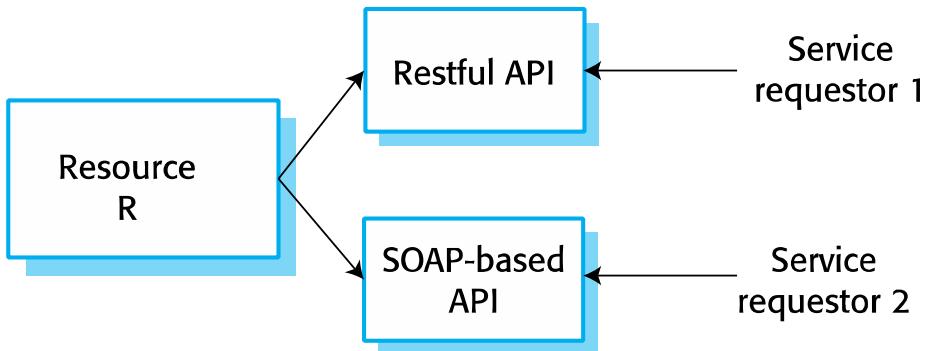
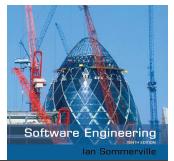
2018-12-14 Jukka Alve

**Edge computing** is a distributed computing concept that integrates intelligence to edge devices, also called edge nodes, allowing data to be processed and analyzed in real time near the data collection source. In edge computing, data does not need to be uploaded directly to the cloud or to a centralized data processing system.



## API (Application programming interface)

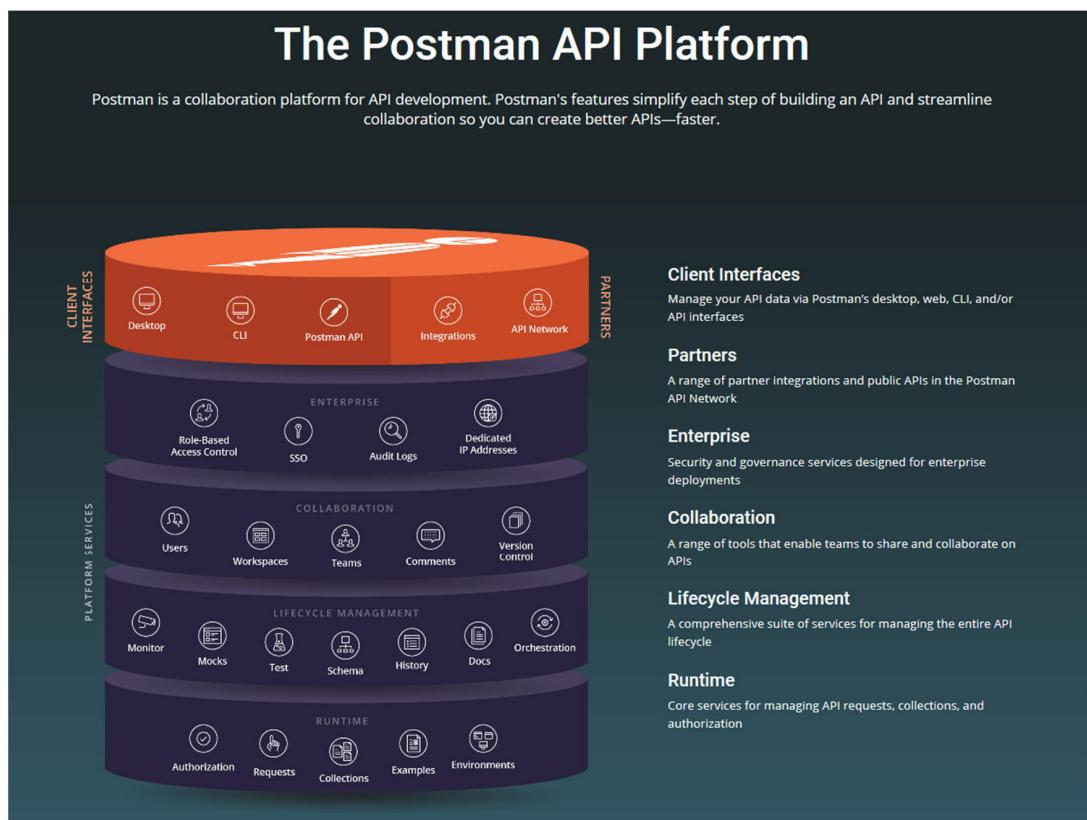
# RESTful and SOAP-based APIs



18.11.2020

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

241



# IPR Intellectual property rights

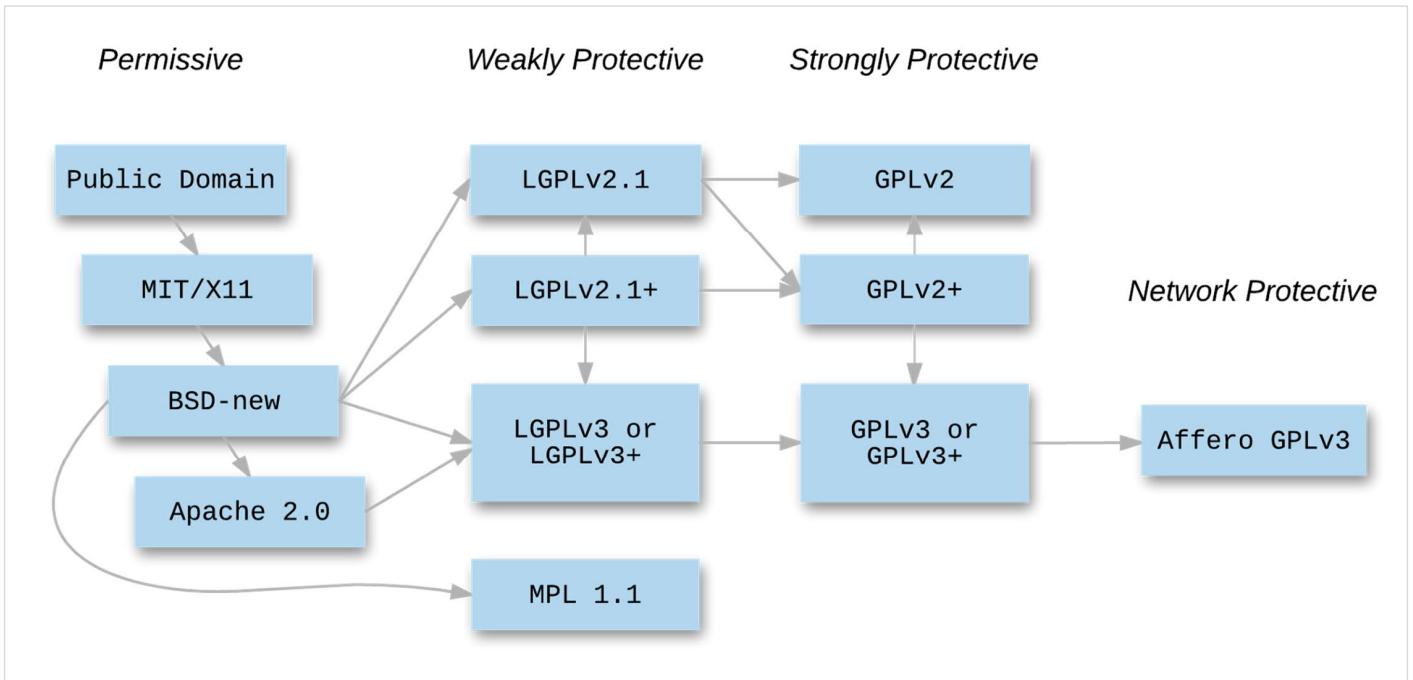
# Licenses

## license web pages

<https://choosealicense.com/licenses/>

<https://medium.com/shakuro/software-licenses-explained-77f4f18ebef1>





[<https://medium.com/shakuro/software-licenses-explained-77f4f18ebef1>]

## Software cost models

[[www.networkmanagementsoftware.com](http://www.networkmanagementsoftware.com)]

		OWNERSHIP TYPE		
		SOFTWARE	APPLIANCE	SERVICE
LICENSE TYPE	PERPETUAL	SOFTWARE "PURCHASE"	APPLIANCE "PURCHASE"	N/A
	SUBSCRIPTION	UNLIMITED SOFTWARE LICENSE	UNLIMITED APPLIANCE LICENSE	SAAS & UNLIMITED APPLIANCE LICENSE
	OBJECT	PER OBJECT SOFTWARE LICENSE	PER OBJECT APPLIANCE LICENSE	PER OBJECT SAAS & PER OBJECT APPLIANCE LICENSE

**about:license**

Binaries of this product have been made available to you by the [Mozilla Project](#) under the Mozilla Public License 2.0 (MPL). [Know your rights](#).

All of the source code to this product is available under licenses which are both [free](#) and [open source](#). A URL identifying the specific source code used to create this copy can be found on the [build configuration page](#), and you can read instructions on how to download and build the code for yourself.

More specifically, most of the source code is available under the [Mozilla Public License 2.0 \(MPL\)](#). The MPL has a [FAQ](#) to help you understand it. The remainder of the software which is not under the MPL is available under one of a variety of other free and open source licenses. Those that require reproduction of the license text in the distribution are given below. (Note: your copy of this product may not contain code covered by one or more of the licenses listed here, depending on the exact product and version you choose.)

- [Mozilla Public License 2.0](#)
- [GNU Lesser General Public License 2.1](#)
- [GNU Lesser General Public License 3.0](#)
- [GNU General Public License 2.0](#)
- [ACE License](#)
- [Acorn License](#)
- [Adobe CMap License](#)
- [Android Open Source Project - Apache 2.0 License](#)
- [ANGLE License](#)
- [Apache License 2.0](#)
- [Apache License 2.0 \(with LLVM Exceptions\)](#)
- [Almost Native Graphics Layer Engine](#)
- [American Fuzzy Lop](#)
- [Android](#)
- [Android Crazy Linker](#)
- [Android Explicit Synchronization](#)
- [Android Open Source Project - App Compat Library](#)
- [Android Open Source Project - Settings App](#)
- [Android Support Library Bottom Navigation Menu](#)
- [Android bionic libc](#)

**Credits**

(Components of) Bazel [show license · homepage](#)

AXE-CORE Accessibility Audit [show license · homepage](#)

Accessibility Audit library, from Accessibility Developer Tools [show license · homepage](#)

Almost Native Graphics Layer Engine [show license · homepage](#)

American Fuzzy Lop [show license · homepage](#)

Android [show license · homepage](#)

Android Crazy Linker [show license · homepage](#)

Android Explicit Synchronization [show license · homepage](#)

Android Open Source Project - App Compat Library [show license · homepage](#)

Android Open Source Project - Settings App [show license · homepage](#)

Android Support Library Bottom Navigation Menu [show license · homepage](#)

Android bionic libc [show license · homepage](#)

## Firefox browser

18.11.2020

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

249



DO WHAT THE FUCK YOU WANT TO PUBLIC LICENSE  
Version 2, December 2004

Copyright (C) 2004 Sam Hocevar <sam@hocevar.net>

Everyone is permitted to copy and distribute verbatim or modified copies of this license document, and changing it is allowed as long as the name is changed.

DO WHAT THE FUCK YOU WANT TO PUBLIC LICENSE  
TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. You just DO WHAT THE FUCK YOU WANT TO.

The WTFPL has basically three parts:

## WTFPL, practical joke

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

**1**

DO WHAT THE FUCK YOU WANT TO PUBLIC LICENSE  
Version 2, December 2004

**2**

Copyright (C) 2004 Sam Hocevar

Everyone is permitted to copy and distribute verbatim or modified copies of this license document, and changing it is allowed as long as the name is changed.

**3**

DO WHAT THE FUCK YOU WANT TO PUBLIC LICENSE  
TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. You just DO WHAT THE FUCK YOU WANT TO.

18.11.2020 250

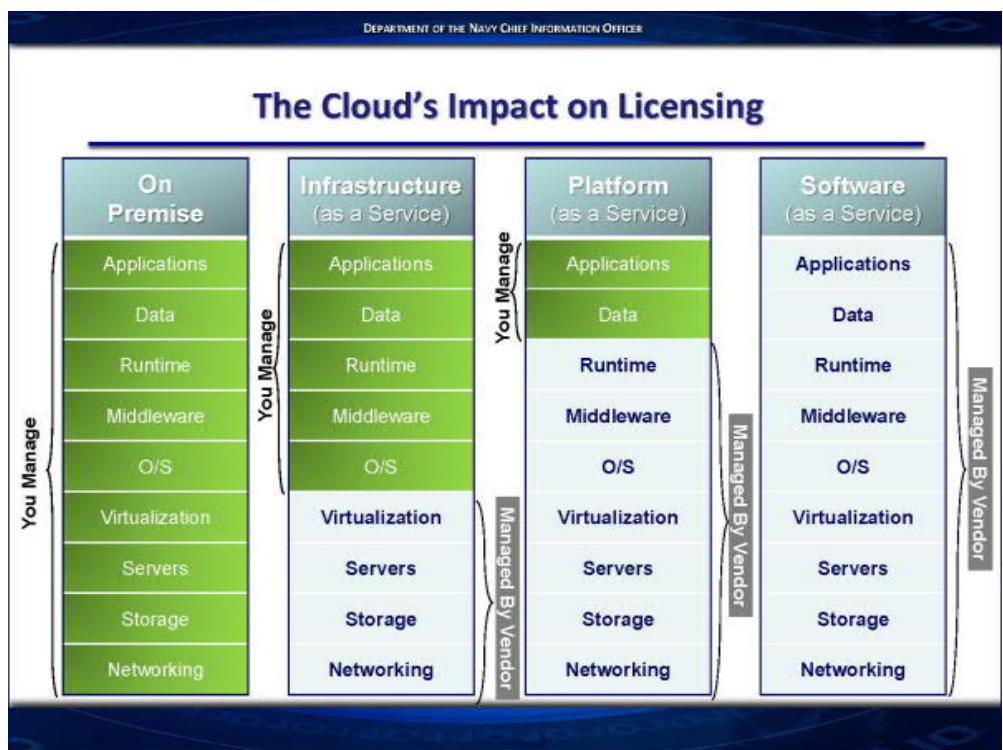
# license web pages

<https://choosealicense.com/licenses/>

<https://medium.com/shakuro/software-licenses-explained-77f4f18ebef1>



IaaS  
PaaS  
SaaS





Press and Information

Court of Justice of the European Union

PRESS RELEASE No 94/12

Luxembourg, 3 July 2012

Judgment in Case C-128/11  
UsedSoft GmbH v Oracle International Corp.

## An author of software cannot oppose the resale of his 'used' licences allowing the use of his programs downloaded from the internet

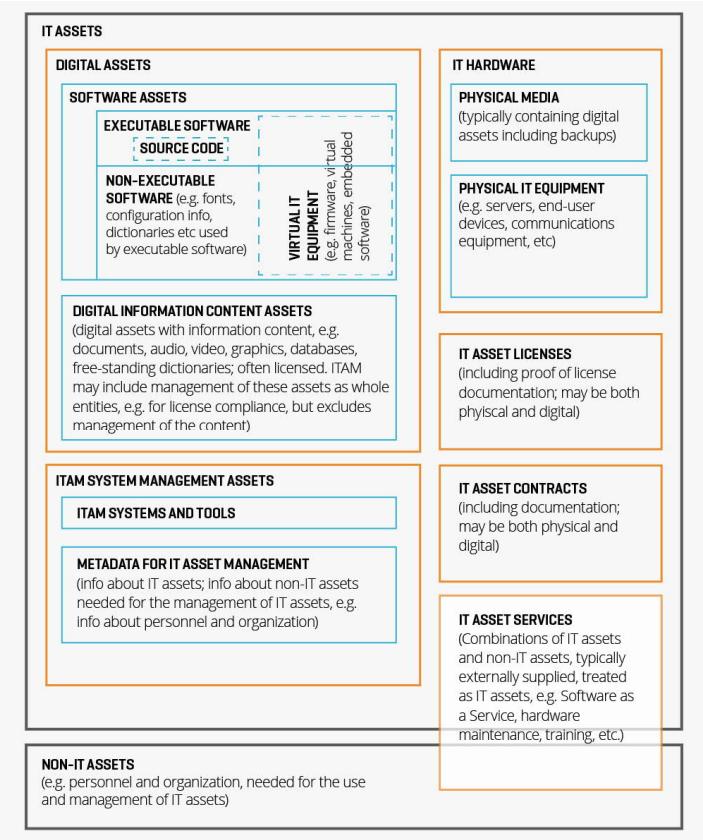
*The exclusive right of distribution of a copy of a computer program covered by such a licence is exhausted on its first sale*

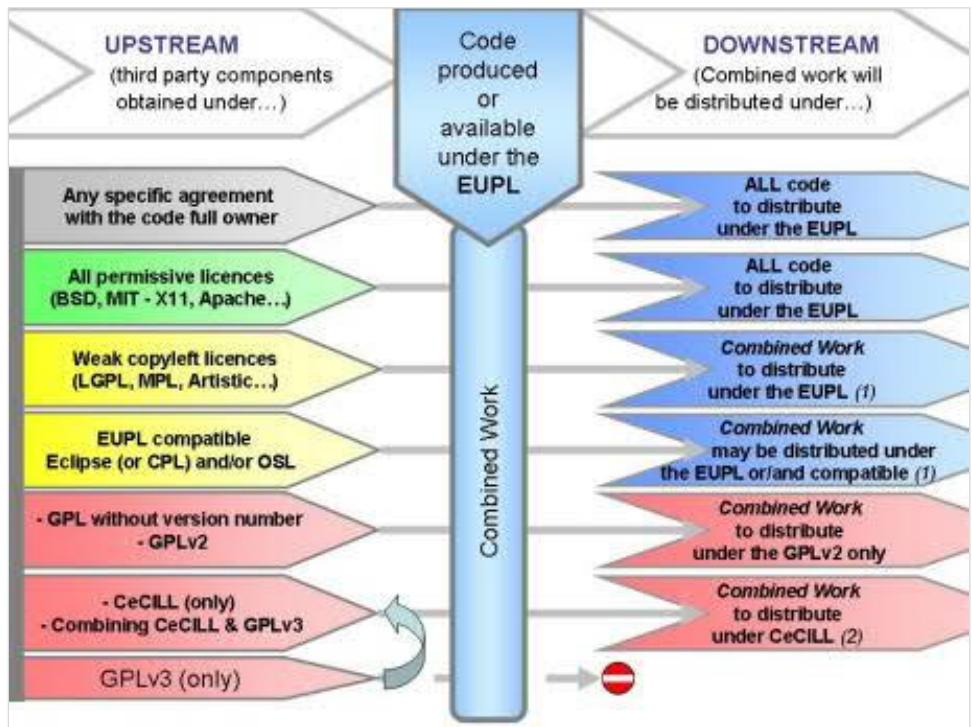
Oracle develops and distributes, in particular by downloading from the internet, computer programs functioning as 'client-server software'. The customer downloads a copy of the program directly onto his computer from Oracle's website. The user right for such a program, which is granted by a licence agreement, includes the right to store a copy of the program permanently on a server and to allow up to 25 users to access it by downloading it to the main memory of their work-station

18.11.2020

TUNI \* COMP.SE.100-EN Introduction to Sw Eng

253





[<https://joinup.ec.europa.eu/collection/eupl/licence-compatibility>]

## Patents

## Patentable inventions

[G-I, 1](#) Patentability requirements

[G-I, 2](#) Further requirements of an invention

[G-II, 1](#) General remarks

[G-II, 2](#) Examination practice

[G-II, 3.6](#) Programs for computers (updated in GL 2018)

– [G-II, 3.6.1](#) Examples of further technical effects (introduced in GL 2018)

– [G-II, 3.6.2](#) Information modelling, activity of programming and programming languages (introduced in GL 2018)

– [G-II, 3.6.3](#) Data retrieval, formats and structures (introduced in GL 2018).

## Novelty and inventive step

[G-VII, 5.4](#) Claims comprising technical and non-technical features (updated in GL 2015)

– [G-VII, 5.4.1](#) Formulation of the objective technical problem (updated in GL 2015)

– [G-VII, 5.4.2](#) Examples of applying the steps listed in [G-VII, 5.4](#) (introduced in GL 2016, with its sub-sections)

– [G-VII, 5.4.2.1](#) Example 1

– [G-VII, 5.4.2.2](#) Example 2

– [G-VII, 5.4.2.3](#) Example 3

– [G-VII, 5.4.2.4](#) Example 4.

## EPO Index for Computer-Implemented Inventions, 3

Features related to the list of [Art. 52\(2\)](#) and technical contribution

[G-II, 3.3](#) Mathematical methods (updated in GL 2018)

– [G-II, 3.3.1](#) Artificial intelligence and machine learning (introduced in GL 2018)

– [G-II, 3.3.2](#) Simulation, design or modelling (introduced in GL 2018)

[G-II, 3.4](#) Aesthetic creations

[G-II, 3.5](#) Schemes, rules and methods for performing mental acts, playing games or doing business (updated in GL 2018)

– [G-II, 3.5.1](#) Schemes, rules and methods for performing mental acts (introduced in GL 2018)

– [G-II, 3.5.2](#) Schemes, rules and methods for playing games (introduced in GL 2018)

– [G-II, 3.5.3](#) Schemes, rules and methods for doing business (introduced in GL 2018)

[G-II, 3.6](#) Programs for computers (updated in GL 2018)

– [G-II, 3.6.1](#) Examples of further technical effects (introduced in GL 2018)

– [G-II, 3.6.2](#) Information modelling, activity of programming and programming languages (introduced in GL 2018)

– [G-II, 3.6.3](#) Data retrieval, formats and structures (introduced in GL 2018)

[G-II, 3.7](#) Presentations of information (updated in GL 2018)

– [G-II, 3.7.1](#) User interfaces (updated in GL 2017).

## EPO Index for Computer-Implemented Inventions, 4

Search practice

[B-VIII, 2.2](#) Subject-matter excluded from patentability under [Art. 52\(2\)](#) and [\(3\)](#) (introduced in GL 2015)

[B-VIII, 2.2.1](#) Computer-implemented business methods (updated in GL 2015).

## EPO Index for Computer-Implemented Inventions, 5

### Requirements of Art. 84

E-IV, 3.9 Claims directed to computer-implemented inventions (introduced in GL 2016, with its sub-sections)

– E-IV, 3.9.1 Cases where all method steps can be fully implemented by generic data processing means

– E-IV, 3.9.2 Cases where method steps require specific data processing means and/or require additional technical devices as essential features

E-IV, 4.13 Interpretation of expressions such as "Apparatus for ...", "Method for ..." (see par. 3).

## EPO Index for Computer-Implemented Inventions, 6

### Requirements of Art. 83

E-III, 1 Sufficiency of disclosure (see par. 4)

Formal requirements for the description part

E-II, 4.12 Computer programs.

# Is JPEG open ?

Forgent JPEG Related Patent

- PUBPAT filed a formal request with the United States Patent and Trademark Office in November 2005 to revoke the patent Forgent Networks Inc. (Nasdaq: FORG) is widely asserting against the Joint Photographic Experts Group (JPEG) international standard for the electronic sharing of photo-quality images. In its filing, PUBPAT submitted previously unseen prior art showing that the patent, which was issued in 1987 to Forgent's subsidiary Compression Labs Inc., was not new and, as such, should be revoked. The PTO granted PUBPAT's request in February 2006 and rejected the broadest claims of the patent in May 2006. In November 2006, Forgent abandoned all assertion of the patent.

[<http://www.pubpat.org/forgentjpeg.htm>]

18.11.2020

TUNI \* COMPSE.100-EN Introduction to Sw Eng

263

# Is JPEG open...

[www.openjpeg.org](http://www.openjpeg.org)

OpenJPEG is an open-source JPEG 2000 codec written in C language. It has been developed in order to promote the use of [JPEG 2000](#), a still-image compression standard from the Joint Photographic Experts Group ([JPEG](#)). Since May 2015, it is officially recognized by ISO/IEC and ITU-T as a [JPEG 2000 Reference Software](#).

18.11.2020

TUNI \* COMPSE.100-EN Introduction to Sw Eng

264

## Let's look about one license in detail; Adobe <https://www.adobe.com/legal/terms.html>

- If you obtained the Software from Adobe or one of its authorized licensees, and subject to your compliance with the terms of this agreement, including the restrictions in Section 4, Adobe grants to you a non-exclusive license to Use the Software in the manner and for the purposes described in the Documentation as follows:
- 3.1 General Use. You may install and Use one copy of the Software on your Compatible Computer. See Section 4 for important restrictions on the Use of the Software.
- 3.2 Server Use. This agreement does not permit you to install or Use the Software on a computer file server. For information on Use of Software on a computer file server please refer to [http://www.adobe.com/go/acrobat\\_distribute](http://www.adobe.com/go/acrobat_distribute) for information about Adobe Reader; or <http://www.adobe.com/go/licensing> for information about the Adobe Runtimes.

- 3.3 Distribution. This license does not grant you the right to sublicense or distribute the Software. For information about obtaining the right to distribute the Software on tangible media or through an internal network or with your product or service please refer to [http://www.adobe.com/go/acrobat\\_distribute](http://www.adobe.com/go/acrobat_distribute) for information about Adobe Reader; or <http://www.adobe.com/go/licensing> for information about the Adobe Runtimes.
- 3.4 Backup Copy. You may make one backup copy of the Software, provided your backup copy is not installed or used other than for archival purposes. You may not transfer the rights to a backup copy unless you transfer all rights in the Software as provided under Section 5.

- 4. Obligations and Restrictions.
- 4.1 Adobe Runtime Restrictions. You will not Use any Adobe Runtime on any non-PC device or with any embedded or device version of any operating system. For the avoidance of doubt, and by example only, you may not Use an Adobe Runtime on any (a) mobile device, set top box (STB), handheld, phone, game console, TV, DVD player, media center (other than with Windows XP Media Center Edition and its successors), electronic billboard or other digital signage, Internet appliance or other Internet-connected device, PDA, medical device, ATM, telematic device, gaming machine, home automation system, kiosk, remote control device, or any other consumer electronics device, (b) operator-based mobile, cable, satellite, or television system or (c) other closed system device. No right or license to Use any Adobe Runtime is granted for such prohibited uses. For information on Software license terms for non-PC versions of Adobe Runtimes please visit [http://www.adobe.com/go/runtime\\_mobile\\_EULA](http://www.adobe.com/go/runtime_mobile_EULA). For information on licensing Adobe Runtimes for distribution on such systems please visit <http://www.adobe.com/go/licensing>.

## Contracts

<b>IT2018-Sopimusehtoliitteet (pdf), esikatseluversiot</b>	<b>Englanninkieliset IT2018-sopimusehtoliitteet (pdf), esikatseluversiot</b>
IT2018 YSE - yleiset sopimusehdot IT2018 EAP - Erityisehtoja konsultointi- ja muista asiantuntijapalveluista IT2018 EHK - Erityisehtoja henkilötietojen käsitteistä IT2018 EJT - Erityisehtoja tietojärjestelmien ja asiakaskohtaisten ohjelmistojen toimituksista IT2018 EKT - Erityisehtoja ohjelmistojen toimituksista ketterillä menetelmillä IT2018 ELH - Erityisehtoja laitteiden huoltopalveluista IT2018 ELT - Erityisehtoja laitetolimituksista IT2018 EOY - Erityisehtoja ohjelmistojen ylläpitopalveluista IT2018 ETP - Erityisehtoja tietoverkon välityksellä toimitettavista palveluista (pilvipalvelu) IT2018 EVT - Erityisehtoja valmisohjelmistojen toimituksista	IT2018 YSE - General terms and conditions IT2018 EAP - Special terms and conditions for consulting and other professional services IT2018 EHK - Special terms and conditions for the processing of personal data IT2018 EJT - Special terms and conditions for deliveries of data systems and customised software IT2018 EKT - Special terms and conditions for deliveries of software using agile methods IT2018 ELH - Special terms and conditions for equipment maintenance IT2018 ELT - Special terms and conditions for deliveries of equipment IT2018 EOY - Special terms and conditions for software maintenance IT2018 ETP - Special terms and conditions for services delivered via data network (cloud service) IT2018 EVT - Special terms and conditions for deliveries of standard software
<b>Ladattavat IT2018-sopimusmallit (docx)</b>	<b>Ladattavat englanninkieliset IT2018-sopimusmallit (docx)</b>
Henkilötietojen käsitteysopimus IT2018 Ketterien menetelmien toimitussopimus IT2018 Konsultointi- ja muita asiantuntijapalveluita koskeva sopimus IT2018 Laitteiden huoltosopimus IT2018 Ohjelmistojen ylläpitosopimus IT2018 Palvelutasokuvaus palvelun käytettävyyden mittauksessa IT2018 Salassapitosopimus IT2018 Tietoverkon välityksellä toimitettavia palveluja koskeva sopimus IT2018 Toimitussopimus IT2018	Agreement for the processing of personal data IT2018 Delivery agreement for software using agile methods IT2018 Consulting and other professional services agreement IT2018 Equipment maintenance agreement IT2018 Software maintenance agreement IT2018 Service level description on measuring usability of the service IT2018 Non-disclosure agreement IT2018 Agreement on services delivered via data network IT2018 Delivery agreement IT2018
<b>IT 2018</b>	

## Non-competition agreement

## GDPR (general data protection regulation)

# Reuse

**Failures were due to not introducing reuse processes, not modifying non-reuse processes and not considering human factors.** The root cause was the lack of commitment by top management, or non-awareness of the importance of these factors, often coupled with the belief that using the object-oriented approach or setting up a repository would automatically lead to success in reuse.

Given a reuse potential due to commonality among applications, the **success of a reuse initiative** depends on a mix of features.

1- Overall, initiating and succeeding in **a reuse initiative** is a technology transfer endeavor, which requires, as a sine qua non, commitment of management.

2 – The approach to **designing a reuse program** seems to be standard, or at least requires considering the same set of elements. Initiating reuse processes, modifying non-reuse processes, and addressing human factors.

3- If the approach is standard, **the way of deploying** it is not. Each element listed above must be approached according to the context of the company.

The design and implementation of networked applications remains expensive and error-prone. Much of the cost and effort stems from the continual re-discovery and re-invention of core patterns and framework components throughout the software industry. The heterogeneity of hardware architectures, the diversity of OS and network platforms, and stiff global competition are making it increasingly infeasible, however, to build networked applications from scratch with the following qualities:

- **Portability**, to reduce the effort required to support applications across heterogeneous OS platforms, programming languages, and compilers
- **Flexibility**, to support a growing range of multimedia datatypes, traffic patterns, and end-to-end quality of service (QoS) requirements
- **Extensibility**, to support successions of quick updates and additions to take advantage of new requirements and emerging markets
- **Predictability and efficiency**, to provide low latency to delay-sensitive real-time applications and high performance to bandwidth-intensive applications and
- **Reliability**, to ensure that applications are robust, fault tolerant, and highly available.

In practice, many factors conspire to make systematic software reuse hard, particularly in companies with a large installed base of legacy software and developers. Non-technical impediments to successful reuse commonly include the following:

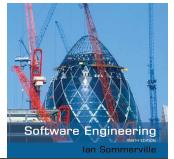
- Organizational impediments -- e.g., developing, deploying, and supporting systematically reusable software assets requires a deep understanding of application developer needs and business requirements.
- Economic impediments -- e.g., supporting corporate-wide reusable assets requires an economic investment, particularly if reuse groups operate as cost-centers.
- Administrative impediments -- e.g., it's hard to catalog, archive, and retrieve reusable assets across multiple business units within large organizations.
- Political impediments -- e.g., groups that develop reusable middleware platforms are often viewed with suspicion by application developers, who resent the fact that they may no longer be empowered to make key architectural decisions.
- Psychological impediments -- e.g., application developers may also perceive "top down" reuse efforts as an indication that management lacks confidence in their technical abilities. In addition, the "not invented here" syndrome is ubiquitous in many organizations, particularly among highly talented programmers.



## CBSE and design principles

❖ Apart from the benefits of reuse, CBSE is based on sound software engineering design principles:

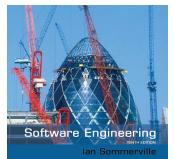
- Components are independent so do not interfere with each other;
- Component implementations are hidden;
- Communication is through well-defined interfaces;
- One components can be replaced by another if its interface is maintained;
- Component infrastructures offer a range of standard services.



## Component standards

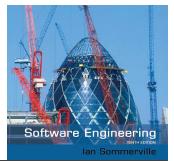
- ✧ Standards need to be established so that components can communicate with each other and inter-operate.
- ✧ Unfortunately, several competing component standards were established:
  - Sun's Enterprise Java Beans
  - Microsoft's COM and .NET
  - CORBA's CCM
- ✧ In practice, these multiple standards have hindered the uptake of CBSE. It is impossible for components developed using different approaches to work together.

## CBSE for reuse



- ✧ CBSE for reuse focuses on component development.
- ✧ Components developed for a specific application usually have to be generalised to make them reusable.
- ✧ A component is most likely to be reusable if it associated with a stable domain abstraction (business object).
- ✧ For example, in a hospital stable domain abstractions are associated with the fundamental purpose - nurses, patients, treatments, etc.

# Component development for reuse



- ❖ Components for reuse may be specially constructed by generalising existing components.
- ❖ Component reusability
  - Should reflect stable domain abstractions;
  - Should hide state representation;
  - Should be as independent as possible;
  - Should publish exceptions through the component interface.
- ❖ There is a trade-off between reusability and usability
  - The more general the interface, the greater the reusability but it is then more complex and hence less usable.